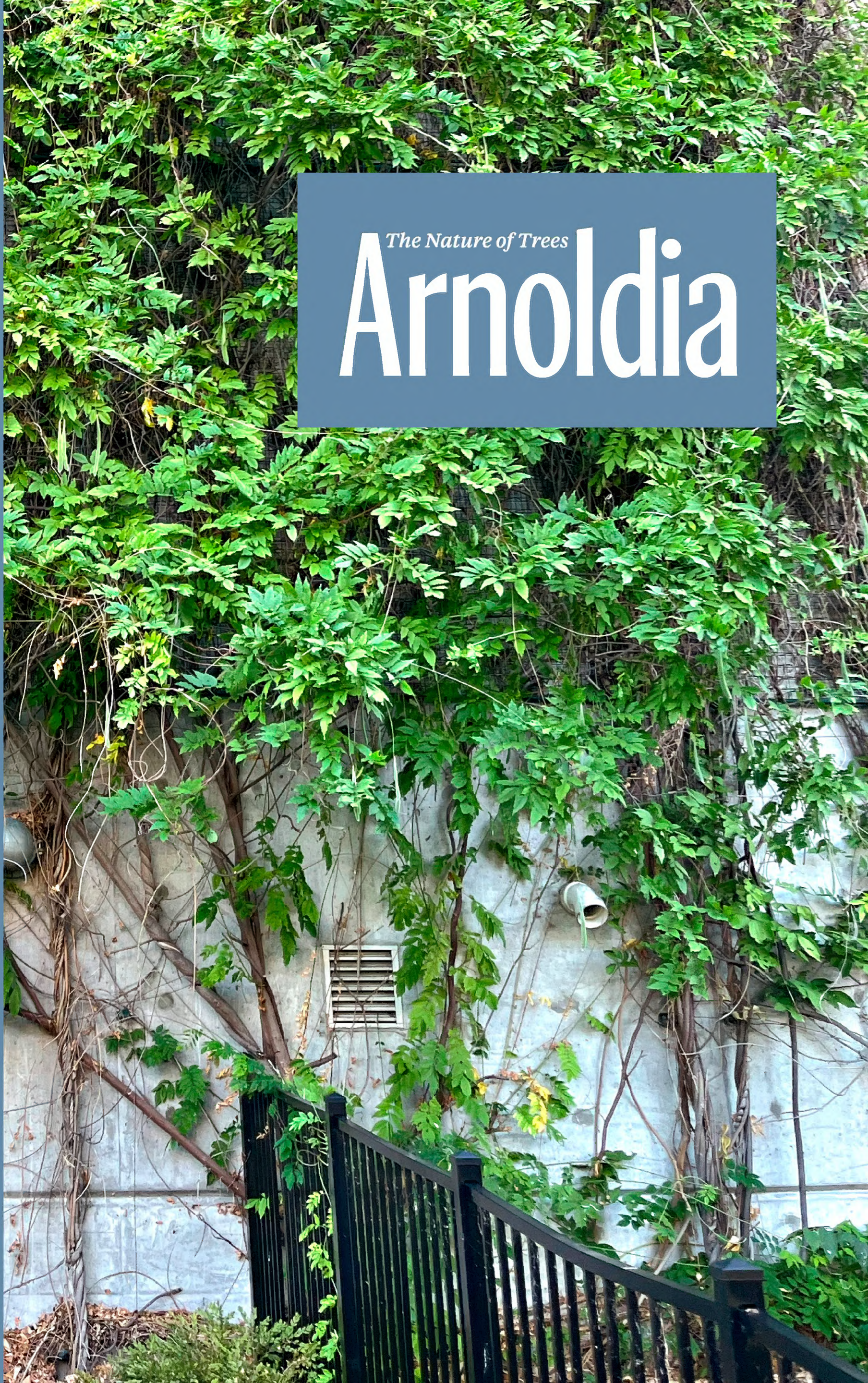


The Nature of Trees Arnoldia





The Ever-Changing Museum

By Michael S. Dosmann

While staking locations for new plants this spring, I paused to marvel at one of my favorites in the Arboretum's collection of around 16,000 plants. Accession 103-31*A is a European hornbeam (*Carpinus betulus*) that we received as a mere whip in 1931 from the famous French nursery of Léon Chenault.

The multi-stemmed species produces numerous, low-branching trunks that do not just grow up, but outward as well. After almost a century, this tree has layered into the earth near Spring Brook in a linear fashion, making it a bit wider in one direction (65 feet) than the other (48 feet). With seven stout stems splaying along a central beam, the tree resembles a ship or some leviathan from the ocean's depths, cresting waves of yellow flowered lesser celandine every spring. The form is so incredible that we bestowed upon it the status of Signature Specimen, an elite Arboretum category recognizing plants that rise above the rest.

The tree differs in other ways from its 1930s look. Initially, it bore the cultivar epithet 'Quercifolia' because of its incised leaves akin to an oak's. Yet within its first decade, the tree reverted to wild type, first producing both normal and oakleaf forms on adjacent branches. Now bereft of any oak-like-leaves, we simply call it *Carpinus betulus*. Trees, and tree collections, change in remarkable ways.

An important lesson for the botanical garden curator is to accept the change that occurs to the objects under your care. After sixteen years curating the Arboretum, my mantra is that you don't just accept changes, you lean into them. Living collections are special. With all due respect to my colleagues in other museums, our objects are not rocks to be assembled, cataloged, and placed in a drawer. While ill-advised, one could leave that cabinet unopened for decades, and those geology specimens would be about the same as the day they went in.

You cannot ignore trees the same way. Some do fine under benign neglect, but the majority—particularly in their first few years—need special attention to establish and remain healthy. We do everything we can to keep our plants that way, but realize that even mature and established plants can be brought to their knees (or pneumatophores, if a bald cypress) by pest, pathogen, or hurricane. Living organisms quietly senesce on their own, too—it is called old age.

In my first year (2007), the Arboretum saw a lot of change. We removed 576 plants from the permanent (non-nursery) collections. Some died of old age. Others were removed (after evaluation) because

they no longer aligned with our updated collections policy. Some removals followed single-accession reviews, others were systematic audits of entire collections. The *Forsythia* on State Lab Slope were the most prominent. After decades of growing into themselves to the point that many individuals' identities (and their backstories) were no longer guaranteed, we grubbed out whole masses of the canary-flowered plants. All told, we removed 64 that year, and another 29 since. (We later planted 50 new shrubs, and the collection received National Accreditation in 2018.)

I think back to other removals, particularly of old, resolute trees. In 2010 we took down a *Magnolia acuminata* (15157*E) near Arborway Gate. This cucumber tree—an 1890 plant from J. J. Dixwell—had a DBH of nearly 40 inches and a height of 70 feet. But, decline followed the damaging 1997 April Fool's Day Blizzard, and fruiting bodies of wood-decaying fungi poured out of its crevices. It simply wasn't going to make it.

This past winter, on February 4th, temperatures dipped down to -11.5°F. The last time it got as cold was 1957 (-12°F). We've started removing plants killed outright, and I know others will struggle for a few years before succumbing. Removals will be most prominent among the youngest, particularly species marginally hardy to begin with.

Between January 1, 2007 and December 31, 2022, we removed 6258 plants from the permanent collections (an annual average of 391, or 2.4%). While I was sad to see them go, I lean into the change, the losses, and call them planting opportunities. Play the deletions out over a decade and you'll see how fast a collection shrinks if you don't have a new plant pipeline. Most new plants do become middle-aged; many survive to dotage. In 2007, 805 plants were at least 100 years old. Thanks to rapid collection growth between 1907 and 1923 (including four expeditions to east Asia by Ernest Wilson), now there are 1348 centenarians.

Due to similar, recent collecting efforts, we've planted 5397 since 2007, an annual average of 337. Eighty percent are still alive, and account for 27 percent of the current

The youngest plants always dominate a collection, no different from a forest floor overrun by seedlings.

collection. Astonishing to think that over a quarter of the plants in the Arboretum have been planted under my watch—until I calculate the number at the start of 2007 that had been planted the *preceding* 16 years: 25 percent. The youngest plants *always* dominate a collection, no different from a forest floor overrun by seedlings. They don't all survive, and only a percentage mature to become centenarians.

As I write this, about 100 trees have been transplanted from the nurseries by our horticultural team this spring; another 180 trees and shrubs in containers await planting. The vast majority were collected as seed from far-away lands: *Acer pycnanthum* from Japan, *Larix laricina* from Wisconsin, *Ostrya carpinifolia* from the Republic of Georgia. With each planting (and removal), our dynamic collection changes in composition and character.

As I get back to pounding wooden stakes into the ground (after marking each with the accession number and scientific name), I think about the ghost trees that came and went in the exact same spot, and also about my predecessors, including whoever sited that European hornbeam (perhaps John George Jack or William Judd). Did they expect it to be around in one hundred years? Would they be surprised that despite losing its defining value (oakish leaves), it changed to become the grandest artwork hanging in Harvard's tree museum's *Carpinus* gallery?

Glancing over the list of what will go out in 2024 or 2025, I see exciting things waiting in the wings. Newly sourced *Davidia involu-crata* from China, devilish *Acer diabolicum* from Japan, and the rarely-found-in-fruit *Cladrastis kentukea* from Tennessee. Rather than wait for change (i.e., canopy gaps) to occur naturally, I may nudge a bit of change (i.e., early removals) to open things up in advance. This will give each new plant—like 103-31*A has done for nearly a century—the opportunity to lean into openings created by trees that came and went. 🌿

MICHAEL S. DOSMANN *is the keeper of living collections at the Arnold Arboretum.*

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The Nature of Trees

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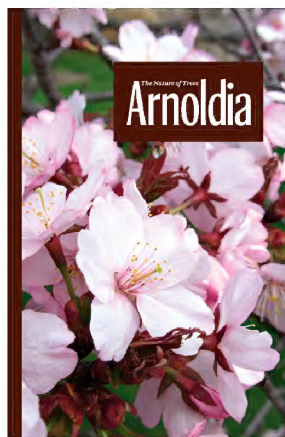
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Author Israel L. Cunha Neto under a trellis with *Wisteria frutescens* (359-2003*^C) in the Arnold's Leventritt Shrub & Vine Garden.



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Clockwise-twining wisteria in Ithaca, NY
Photograph courtesy Israel L. Cunha Neto

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Notes from the Field



When a Pot is More Than Just a Pot

Bonsai specialist **Jun Imabayashi** explains the nuances of repotting centuries-old living artworks.

At the mention of an upcoming meeting about repotting bonsai at the Arnold Arboretum, a friend expressed confusion. “What’s so important about the *pot*?” they asked. Groping for an answer, we replied that many of the plants in our bonsai collection are centuries old; repotting them is like choosing a new frame for an Old Master painting.

Jun Imabayashi is the bonsai specialist for the Arnold Arboretum. This essay is drawn from conversation with Jun, whose remarks have been condensed and edited for publication.

What’s so important about the pot? Confronting this question, Jun Imabayashi, the arboretum’s bonsai specialist, goes back to basics. He points out that *bonsai* essentially means “pot” or “potting” in Japanese (*bon* “tray” + *sai* “planting”). Long-lived trees in vessels—this is the very magic of bonsai, the basis of the wonder it engenders in us. Thus like a fine painting’s frame, the pot

needs to match and support the character of the tree. Of course, some of that character is fixed, but some of it is ever-changing, as the plant grows and senesces, ebbs and flourishes, over a lifetime that can encompass centuries (some trees in the Arnold’s bonsai collection approach 300 years old). At the same time, the essential role of the vessel in the art of bonsai transcends both etymology and aesthetics. For the pot is a vessel for *living* in; it must support the plant’s flourishing and growth. In this sense, the analogy to frames and rare paintings is inadequate—for in the case of bonsai, the work of art is ever-changing, the masterwork ever repainting itself.

Aesthetics do govern the process, however. Every tree needs a face, a front, Jun

explains; it might want to be placed off-center in the pot for the sake of balance, to create negative space. “It’s not like a flower arrangement, to which you’re just adding adding,” he says, his hands stuffing imaginary herbaceous material into a vase. “With bonsai, we mostly are taking away.” As material is taken away, he explains, more of the tree becomes visible.

There are rules of thumb, too: deciduous trees want a shallow pot that is round or oval; the conifers often like to show off in tall, angular containers. For display, a tree will be dressed up in a special pot, often very shallow. And yet the plant will need more watering and attention in such shallow pots. Thus, for long-term care and display, Jun prefers to go one size bigger than he might otherwise choose.

Jun also tries to match old trees with vessels of commensurate age. Pots don’t grow, but they do age, Jun points out, and so it’s important to find pots with patina to match the venerable glamor of the trees. Such patina can be subtle. Jun shows off one pot he picked up on a recent trip to

Repotting a centuries-old bonsai is like choosing a new frame for an Old Master painting.

Japan: with a volume of perhaps a gallon—not much larger than an old-fashioned desk phone—the vessel is pentagonal in cross-section, with a handsome, rolled lip and gently scalloped feet at the corners, its soft, unglazed taupe color seeming to dissolve into itself. When Jun saw the pot, he immediately thought of a particular hundred-year-old juniper at the Arnold. He carried it back to the U.S. in his luggage.

For all the importance of pots, their provenance is not tracked, although the arboretum does keep the original pots in which trees arrived. They might prove useful again as the trees grow into and out of new shapes and relationships.

Repotting is more than an automatic affair, as it combines aesthetic consideration with the needs of plant health. As such, it mostly happens in a narrow time frame in spring, coincident with the beginning of the trees’ most active growing season. Repotting can facilitate this growth or hamper it. It’s a delicate time. The week after repotting is most crucial, as Jun and colleagues mist, water, and feed the plant with special care.

FROM THE ARNOLD

Intersections and Close-ups

As the weather warms up and the arboretum’s flora comes into its prime, don’t forget to take a break after your outdoor stroll to explore the beauty *inside* the Hunnewell Visitor Center, where two new exhibits opened in March.

“Intersections: Pairings of Botanical Art and Herbarium Vouchers from the Collections of the Arnold Arboretum” includes dried specimens such as lilac (*Syringa vulgaris*), Southern catalpa (*Catalpa bignonioides*), dove tree (*Davidia involucrata*), and more, thoughtfully displayed side by side with their artistic rendering, allowing for easy comparison and appreciation. “Still Lives: Plants of the Arnold Arboretum, Close Up and Far Away,” features spectacular photography by Vaughn Sills. Specimens collected from the arboretum are juxtaposed against different backgrounds from within the artist’s studio as well as from the natural world, encouraging viewing from different vantage points. Sills’ photographs will be on view through June 25, while “Intersections” is up until September 10, 2023.





GREEN CITIES

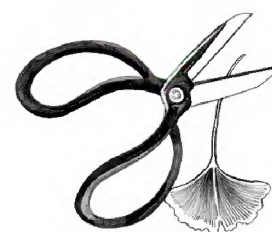
A Tree Flows in Belgrade?

In a rapidly changing and ever more technology-driven world, trees offer a welcome respite—they provide ecosystem services such as carbon sequestration and groundwater retention, shade and natural beauty. Such services cannot be replaced by technology. Or can they? Recently, Dr. Ivan Spasojević of the University of Belgrade designed a novel alternative, a “liquid tree”—a 600-liter aquarium meant to reduce greenhouse gas emissions and help improve air quality. Referred to as LIQUID 3, the unit is a photobioreactor filled with water and microalgae that photosynthesize, binding carbon dioxide and producing oxygen. LIQUID 3 comes with some impressive statistics: since microalgae photosynthesize at rates 10 to 50 times more efficient than trees, a single aquarium produces the same amount of oxygen as two ten-year-old trees. LIQUID 3 can also be used as a bench, and comes equipped with phone chargers and solar panels for night lighting. So—will liquid trees be making an appearance at the arboretum anytime soon? Not likely. The creators of LIQUID 3 aren’t advocating for the replacement of trees. Instead, they expect to locate units in dense urban areas with high levels of pollution where planting trees isn’t feasible. While these futuristic aquaria certainly serve up food for thought, it’s impossible to imagine them replacing the joys that trees provide.

If the pot doesn’t work out, Jun will wait until the next year to try again—to repot again would put the plant under too much stress. “With a surgery, people think of the operation in the hospital as the hard part. But after the operation, you still must stay in the hospital,” Jun points out.

In the shed where the bonsai overwinter, Jun turns to a low shelf holding the original pots in which some of the plants arrived at the arboretum—great bowl-shaped vessels of caramelly terra cotta the size of truck tires, now more than a century old. These big vessels weren’t for showing off the bonsai, however, but for transporting them—the pots are too big for permanent display, but were probably sized to protect the plants in transit. Indeed, they’re too big for long-term use—with the greater soil volume of a large pot, it can be difficult for the soil to warm up to temperatures optimal for the health of the plant.

Jun points out that often, collectors and enthusiasts are in a hurry to achieve a specific visual effect with a tree, which they want to fix in perpetuity. “But the trees are alive,” he points out; “supposedly, this is just the beginning” of a long process of changing and unfolding form. Traditionally, changes happen slowly, over years and years, and successive repottings unfold in the rhythm of the tree’s long-term relations with collectors, connoisseurs—and foremost, with caregivers. Jun is mindful of his relationship with past bonsai artisans at the Arnold, who collectively have tended the trees for more than a century. He muses too on the long lives of the plants themselves—and the way they have always been entwined with people, through good times and bad, times of war and displacement. Through it all, Jun notes, people cared enough about bonsai to keep them, protect them, nurture them—and move them to safer ground, even over oceans. The vessels these plants have seen are varied indeed. 🌿





A Finer Constitution

For **Matthew Battles**, an ancient tree prompts a question: who decides the fate of the forest?

Walking Road 302 in the Willamette National Forest in early summer, a dirt track, still gated and shut for the season. Up the road a trailhead emerges, blazed with a router-lettered sign: EXPERIMENTAL WATERSHED TRAIL. The map shows the trail rising through a sinuosity of switchbacks before contouring around the shoulder of the ridge to cross four headwater streams, which converge to flow out of the understory into Lookout Creek below. The switchbacks ascend the face of the slope with coiled energy through gardens of fairy slipper, whole Jurassic Parks of sword ferns bursting like fireworks. Everywhere, flakes and fragments of *Lobaria* lichen litter the moss. Trunks of giant Douglas-fir

(*Pseudotsuga menziesii*) buttress the overstory, a colonnade hazy with mid-height hemlocks and slender red cedars. This is old growth in its glory, and the switchbacks climb the ridge past cathedral heights of midlevel canopy.

The trails like to tell stories; they encourage comfort, conduct the walker along in an easy cadence, a green-and-shadow strobing that blurs into forest. Trodden down and worn smooth, patted to firm soil punctuated by the boot-worn knuckles of roots, trails are scaled to our feet, shaped to our loping, bipedal transits. To go off-trail in the old growth, by contrast, is to enter another realm. Beyond the furling margins of a trail, our sense of scale is disrupted—the forest floor is a jumble, a living cloud: moss overlying latticed logs, the bodies of roots bottomless beneath the littered blanket of green. Shreds of nitrogen-fixing *Lobaria* lichen rest on the moist duff like forgotten handkerchiefs. Every surface photosynthesizes.

Matthew Battles
is the editor of
Arnoldia.

Although it seems frozen, the forest is in motion, even turmoil—every arc and angle speaks of gravity, strain, tension. The time scale of this drama unfolds remote from our own sense of lived time. At eye level, the base of an ancient Douglas-fir seems a ruin of shrapnel bark, scales and flakes and fragments, all seemingly piled for the pyre, a frozen explosion of bark-borne woody becoming. The bark's fissures run deeper than fingers can find, shadowed cracks hung with filamentous hyphae and the catenary bunting of spiderwebs. More than two of my arm spans in circumference, the trunk's cooperage seems ponderous, sham-bolic; peering upward, I see the shaggy pile of the tree refined into an arcing pillar, a swoop of wood, a mast of living tree whose first limbs erupt a hundred feet above my open mouth and staring eyes. Up above, the epiphyte-tufted limbs whorl into a canopy, a furred and chambered world; although the *Lobaria* lies in shreds around my feet, it's out of sight high above. And the whole bole and bough of it stands in a swooping lean, out of line with any conceivable center of gravity; the very floor of the forest is tugged and levered upward, the sphagnum stretched taut as a tent, where the tree leans away from it. This tree is looking to lie down.

There is a life for the tree, and a life for the log. And these two states intermingle. Much of any standing tree, after all, is already dead matter—the heartwood, sealed with lignin, is by most accepted definitions inert. The tree treasures its death within itself, relies on it; the living tree is a habit worn by the dead, a cloak of vital tissue, ragged in spots, but nonetheless contiguous and communicate with itself and the world beyond.

Now, the trail levels out to contour the ridge through thickets of vine maple and wickerworks of bare and new-budding branches, over openings carpeted with last year's leaf litter now faded to the color of old newsprint, sunlight falling through gaps in the canopy. Push through a thicket of vine maple—reedy, bending clusters of green boughs, converging in thick sunstruck tangles wherever the canopy has broken

At eye level, the base of an ancient Douglas-fir seems a ruin of shrapnel bark, scales and flakes and fragments.

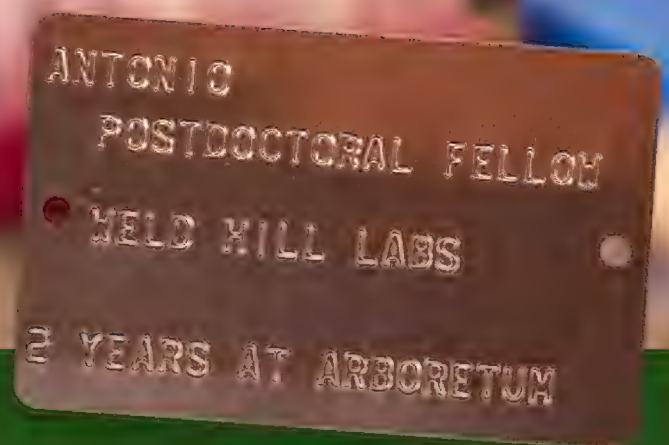
open—and come to a tight bend. Here the trail contours hard by a looming wall: the cut end of a great log, perhaps five feet in diameter, and smooth, the wood weathered to gray, its annual rings standing out in crosscut relief.

Having no appointment to keep, and ready for a rest, start counting the rings, outward from the heart. Working out from the sapling center, a count of one hundred barely gets halfway to the bark. At this point in its life, the tree started laying on wood in thin layers. Reaching two hundred, there is still a long way to go to the outermost. The layers diminish in width, now thinner even than the thumbnail that gauges them. The living, growing tree—which at the time it was cut might have contained 15,000 lbs of lumber-grade wood—in any given year would have been comprised mostly of a gossamer integument, this liquid layer of cells, this vital habit enrobing the heartwood. 299, 300, 301, though the count might have missed a ring here or there; 308, 309, 310 to the breaking bark.

As a provision of the Treaty of Utrecht, signed in 1713, France ceded the maritime provinces and the lands around Hudson's Bay to Great Britain. In the Carolinas, English colonial militias aided by their Cherokee allies defeated the Tuscarora and seized much of their territory. Though the peoples who lived here already felt their presence in trade, displacement, and disease, this land, *here*—the Cascades range, the Pacific coast south to Baja—the northern Rockies, and the great plains stretching east beyond the Missouri River—had yet to be permanently claimed by any European colonial power. The U.S. Constitution would not be ratified for three quarters of a century. The Congress that it brought into being would create the Forest Service nearly two hundred years later, in 1905. The science of old growth was born here half a century later. And now, in this uncertain future beyond the cut, we finally begin to ask: is it not strange for governments to presume control over landscapes and organisms, beings, whose lifespans are greater than their own? 🌿

A smiling man with a beard, wearing a dark lab coat, is in a laboratory setting. He is standing in front of a microscope and various lab equipment. The background is slightly blurred, showing shelves with bottles and other lab supplies.

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Ulmus × *hollandica* 'Christine Buisman'

By Chris Copeland

In the fall of 1918, with the dust of the First World War still settling, reports of a mysterious “elm death” spread across northern Europe. As anxieties grew and speculation swirled, there was need for serious science to be done.

By 1921, Director Johanna Westerdijk of the Willie Commelin Scholten Lab in Baarn, Netherlands oversaw a total of 56 researchers devoted to the elm question, almost half of them women. Barendina Spierenbeurg first reported the excessive decline of European elms. Marie Beatrice Schwarz linked the wilt to a new fungus species, which she named *Graphium ulmi* (now *Ophiostoma ulmi*). By the time the elm disease hit Britain in 1926, it was widely known as Dutch elm disease.

In 1927, Dr. Christine Buisman identified an alternate stage of the fungus life cycle, shedding light on how it reproduces. As a fellow at Harvard’s Radcliffe College in Cambridge, Dr. Buisman used the Arnold Arboretum’s elm collection to study dieback diseases. Just before her departure from the arboretum in 1930, Buisman identified the first case of Dutch elm disease in the U.S., on a twig sample sent from Ohio.

The discoveries of these Dutch scientists spurred efforts aimed at restoring the elm to the streets of Europe. In 1935, the lab found a resistant selection of *Ulmus* × *hollandica*, known as clone 24. Following Buisman’s sudden death in early 1936, *U.* × *hollandica* ‘Christine Buisman’ was planted widely as a street tree throughout the Netherlands. The Arnold received this clone in 1946, the first year that it was distributed to the United States. Individuals 135-54*B and 273-46*A are alive today, just a few hundred feet from where this article was written.

Although tolerant of Dutch elm disease, the clone would prove susceptible to other cankering fungi and suffered widespread storm damage. This influenced elm improvement programs to select for cold hardiness, flood tolerance, and stronger branch unions. A newer American elm, ‘Jefferson’, introduced in 2004 by the U.S. National Arboretum and National Park Service, was found to have a unique triploid genome. Suggesting that resistant genotypes exist in the wild, the mutation emphasizes the importance of wild genes for the next century of elm improvement. 🌿

Chris Copeland
is the assistant
manager of
plant production
at the Arnold
Arboretum.

135-54*B *Ulmus*
× *hollandica*
‘Christine
Buisman’.
Photograph by
Chris Copeland





GLEANINGS

Foraging in the Archives

By Holly Haworth

“We are continually overflowing toward those who preceded us, toward our origin, and toward those who seemingly come after us.... It is our task to imprint this temporary, perishable earth into ourselves so deeply, so painfully and passionately, that its essence can rise again ‘invisibly,’ inside us. We are the bees of the invisible. We wildly collect the honey of the visible, to store it in the great golden hive of the invisible.”

— *Rainer Maria Rilke*

Say a lone honeybee, foraging for nectar, lands on a hidden patch of goldenrod several miles from the hive, on the other side of the mountain, in a little clearing next to a stream. In the afternoon sun, she drinks from some 50 to 200 flowers, until she is full. Then she flies back to the hive. Upon return, when her sisters see her, she vibrates her wings and abdomen at a particular amplitude, frequency, and angle—a certain shake, a certain quiver. She pivots in a figure-eight pattern in space, beating her wings as she cuts a straight line, then turns in a circle and holds her wings still.

Young trees tangle in a grove of sassafras (*Sassafras albidum*) in Georgia, where the author forages their roots. All photographs courtesy Holly Haworth





With these complex gestures, the bee communicates the direction of the food source relative to the sun's position in the sky; the duration of the dance indicates how far away the nectar lies. It is a dance performed for a singular occasion, constituting a kind of ephemeral archive, a record of the route to the nectar that fuels her dancing—a language, certainly. Having witnessed the dance, the other honeybees will find the patch of goldenrod blooming on the other side of the mountain and drink from it.

The hive itself, its cells packed with honey, houses a physical record of every single wildflower that was visited by members of the hive in one place on Earth in a passing season, the sweet essence of each flower, inscribed into invisible-to-the-eye DNA traces. A drop of honey on your tongue is an archive of nectar slurped by the bristly tongues of forager bees, spit into the mouths of worker bees at the hive who held it under their tongues until it turned to honey, then stored it in cells within the hive.

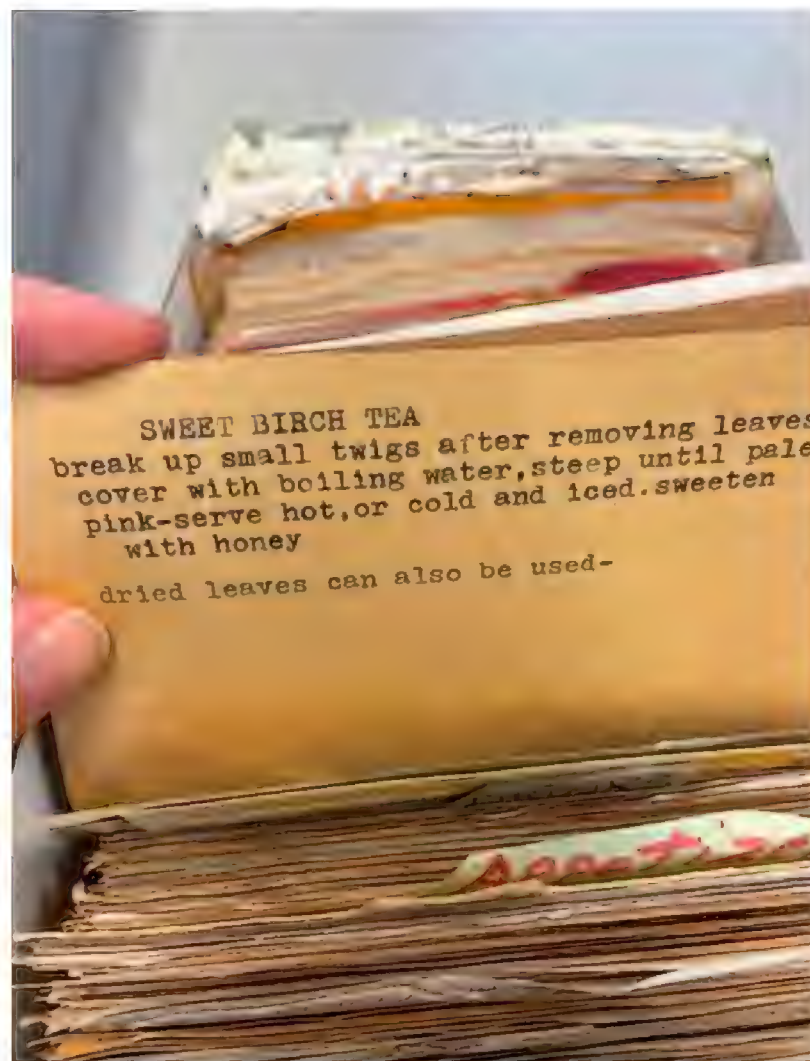
The word archive can be traced to the Greek *arkheion*. The French philosopher Jacques Derrida tells us in *Archive Fever* (1995) that the *arkheion* was a house, a dwelling-place of the magistrates, where official documents were filed and stored. This leads us to the Greek *oikos*, the home or dwelling of a common person, the word that is at the root of *ecology*,

and so ecology is the study of the home, every home an archive of ecological events and relationships.

Visiting the archives at the University of Georgia, I landed on the 28-box collection of a botanist named Marie Mellinger. Born as Marie Barlow in 1914 at the edge of a forest in Wisconsin, she settled with her husband Mel Mellinger in Rabun County, Georgia in 1958, where she lived until her death in 2006.

A self-taught naturalist, she “built a scholarly reputation through exhaustive botanical surveys,” according to her obituary, and penned the *Atlas of the Vascular Flora of Georgia*. She became the first non-Atlanta president of the Georgia Botanical Society. The collection holds her scrapbooks of pressed flowering plants, an extensive and meticulous index of flowering plants with citations to published works that give further botanical information, clippings of stories about Mellinger from local and regional newspapers, and several sleeves of her 35 mm Kodachrome film slides of plants and landscapes.

As I dug through, I came across a hefty box containing Mellinger's recipes for dishes prepared with wild edible plants native to or naturalized in the mountains of North Georgia. The box was stuffed full of hundreds of recipe cards, so packed with them that there was no empty space in which to flip



the cards from one to the next, and I had to pull each one out to read it. I was immediately enamored with recipes for stews of chickweed, salads of cress and cattail shoots, wood-sorrel sauces, walnut-persimmon cakes, sautéed kudzu, and birch-leaf tea.

Recipe boxes have been kept throughout written history in the homes of common people—women, mostly, in the cabinets and on the counters of kitchens, the cards inside accruing splatters and stains over time from boiling pots and dripping spoons. Though they constitute significant archival efforts, these rich collections are rare in “the” archives, considered less significant in the annals of history filed at the houses of the magistrates.

Derrida reminds us that the archive is justive—it decides not only what is remembered but what is memorable. The recipe boxes of mothers and grandmothers have been passed to daughters and granddaughters, home to home, living archives to which new recipes are added, old recipes pulled out of the box again and again. They were not deemed as memorable in official history as a host of men’s affairs were, though eating is the daily act that has fed and nourished everyone throughout history.

Records of foraged meals are even less archived, it seems, and this is what caught my eye about the box in the Marie Mellinger collection. They pointed not only to a meal prepared and eaten but to the unwritten, singular acts of gathering that the meals’ preparation required each time. These recipes gestured viscerally toward the mountains and fields beyond the kitchen in which Mellinger cooked, the *oikos* that gave her life sustenance.

Mellinger’s meals of wild edibles collected throughout the 1970s were set apart from the store-bought culinary culture that rose to ascendance in the 1950s and still constitutes the industrial mainstream (which speaks also to ecological relationships), and even from the meals that one might prepare with vegetables harvested from a garden. They suggested not only field but forest, not only fertile valley but windswept ridge. A woman’s life not confined only to the grocery store or kitchen. A wider, wilder frame. To me, the box of recipes painted an intimate portrait of a life lived in a particular place on Earth, and its many passing seasons. A forager myself, for days I rifled through the box, as if to satisfy a hunger, to drink a nectar. Purslane pickles, burdock candy, dandelion coffee, smilax jelly, mulberry spritzer, sassafras tea, elder flower fritters, stewed chicken of the woods mushrooms.

Sitting in the quiet, stale, and light-filled reading room of the university's archives, reading the recipes, I thought of roaming the woods. It was the middle of March, and sorrel was speckling the forest floor. Instead of sitting there, I might have been picking the heart-shaped leaves of violet and collecting them in a basket for a salad. It was the time to harvest chickweed, too, the leggy stems of which I would chop with my knife and blend with olive oil to make a green pesto. I would have liked to forage, to make a savory pie with henbit and cleavers. But I was held spellbound inside, foraging for sustenance of a different sort—a kind of sweet essence.

Mellinger's archive of recipes made with foraged plants is not like the hive-archives of bees, not itself an edible honey. Yet, it is a record of wild plants that bloomed and grew, that were collected and eaten throughout a lifetime. The box of recipes seemed to be a record of motions as fleeting as the visitation of bee to flower.

While alive, Mellinger showed hundreds of people the path to the hidden patch of goldenrod on the other side of the mountain, leading a group she called Incredible Edibles. For some four decades, she took participants (many of them the young people of Rabun County, Georgia) on foraging walks and hosted meals. The tradition of foraging has been carried on primarily this way. A person follows another person, who spots something growing that she likes to eat, snaps off a stalk or pinches a leaf, says, "Here, taste this," says, "Let us gather some, for soup."

There are subtle cues involved in the positive identification of a plant—a certain wintergreen scent in the bark of cherry birch (*Betula lenta*), say, that distinguishes it from black cherry (*Prunus serotina*), or the instant heady-spicy aroma when one crushes a spicebush leaf. The nuance of purple spots on the smooth stalks of water hemlock that communicate "poison," compared to the very fine hairs on the spotless stalk of wild carrot, hemlock's close relative, that say "safe." The texture of a leaf, its roughness, fuzziness, or smoothness, can conjure a name without hesitation. Information like this has been passed down from sensing body to sensing body for hundreds of thousands of years.

Wendell Berry has written that "(e)ating is an agricultural act." Foraging precedes the dawn of agriculture, and yet it points to an attentive relationship with plants as the foundation of human culture, much more ancient in our species' DNA (~300,000

years) than the somewhat recent domestication of seeds (~10,000 years). The survival of our species is thanks to generation after generation being shown the path to plants that were edible and nutritious.

Agriculture suggests fields as opposed to forests, but foraging might be done in any terrain at all where people roam and plants grow, and forests are particularly rich sites in this regard. Archaeologists now understand that where colonizers perceived vast stretches of untended forests, or "wilderness," in North America, they failed to see the signs of the tending, cultivation, and harvest of wild plant populations that Indigenous cultures practiced in woodlands. More than mere gleanings, foraging entails caring for patches of plants or stands of trees so that they might continue to grow and bear fruit in perpetuity.

I observed this years ago when I was writing about wild ginseng, a plant whose populations have been severely depleted due to overharvesting. A man in the mountains of East Tennessee led me through the woods to "his" patch. Every fall, he carefully gathered the berries and planted them, nurturing the growth of new seedlings. He had a method for keeping the ginseng well-hidden, so that it wouldn't be poached by "sang" hunters who wanted to dig its roots for their high cash value on the global market.

Mellinger packaged the seeds of around 600 of her favorite species of wild plants gathered on her foraging walks, sealed them in little envelopes labeled with their botanical names, and distributed them around North Georgia. Among them were goldenrod, sourwood, pokeberry, and yellow-eyed grass. She never revealed where she found rare plants. She lamented the increasing rarity of *Hydrastis canadensis*, or goldenseal, another plant harvested for medicine. She opposed the gathering of plants for herbaria, which she thought could be replaced by the use of photographs. "Think before you clear land or cut anything," she advised citizens in an interview with a local newspaper. Near the end of her life, she began to speak out strongly against pesticides. When I opened the box of recipes, placed atop the cards longways was a folded clipping from a magazine about the harms of pesticides and herbicides.

If practiced as a stewardship, foraging can encourage populations of wild plants to become more robust and widespread. It can give reason to protect land and conserve forests. If not practiced carefully—full of care, that is—it carries the danger of eradicating wild and medicinal plants from their habitats. Forests and the wild edges of fields, and all places where

Practiced as a stewardship, foraging can encourage populations of wild plants to become more robust and widespread.

plants grow and people roam, are also archives, then, tended to by their cultures. They are deep stores of history that can tell us much about the past and the relationships that people have had to plants and trees in particular places. A forest is a dwelling-place, or *oikos*, that must be preserved, while at the same time it serves to preserve its attendant human cultures and provide sustenance and medicine in the present day.

During a seminar she taught at the Hambidge Center called “Reading the Landscape,” Mellinger led participants to a Southern Appalachian mountain cove, past a fallen chestnut—dead half a century, since the chestnut blight, imported accidentally on Asian trees, swept through and eradicated the primary wild food source of Eastern forests. She gathered the group under a beech tree, her favorite species of tree, with which she liked to make “coffee” from the roasted nuts, and a tonic from the young leaves. “Today I have grown taller from walking with trees,” she read from a paean to forests she had composed from various sources. “I would not say that trees at all were of my blood or race, yet lingering where their shadows fall I sometimes think I trace a kinship.” Mellinger cried, her tears dropping into the leaf litter.

“I get very emotional over forests,” she told an interviewer who attended the seminar, “because the forest means something special to me. The feeling I

have about forests is—well, it’s just something you absorb when you live with a forest.” I imagine her sipping roasted beech-nut coffee, baking persimmon-beech-nut bread. In *Archive Fever*, Derrida discusses Freud’s “death-drive,” which “destroys in advance of its own archive.” The act of eating might be seen as this, a sort of anti-archival act, as the food is destroyed after it is harvested, consumed, and leaves no record. But our bodies are also archives, housing the seasons of eating. In foraging, as we eat and imbibe the plants and trees near us, we absorb the forests with which we live.

Paleontologists who analyzed the mummified corpse of a man who lived around 5,000 years ago in the Alps (now known popularly as Ötzi) found in his stomach the pollen of the hop hornbeam and hazel trees that were blooming at the time of his death, in late spring; undigested einkorn wheat, harvested and stored from the previous fall; six different mosses; fern spores; pine pollen, and the pollen of 30 other plants and trees.

“Live in each season as it passes; breathe the air, drink the drink, taste the fruit, and resign yourself to the influences of each,” Thoreau wrote in his journal in August of 1853. He was known to rhapsodize about picking and eating wild blueberries and huckleberries. As seasons layer into years, every forager knows,



“Today I have grown taller from walking with trees”—Mellinger in the woods she loved, foraged, and stewarded.

each season becomes a store of memories of previous years: what popped up, leafed out, ripened, budded, flowered, fruited at a given time, what was cooked and eaten when the angle of the setting sun was just so, the bite in the air of a certain sharpness.

And every year we are a little older, our bodies accumulating more records. In this way, we are something like trees, with their concentric rings that tell of drought years and fat years, and their scars from limbs lost, the marks of each year's new growth, and wind-bent crowns. So also our teeth, bones, hair, and skin house histories of the years, of minerals and other traces of our living. The journalist who wrote about Mellinger's seminar described her cheeks as "weathered." Ötzi's skeleton indicated that he had spent his life walking over mountainous terrain. The feeling Mellinger had about forests, she said, was *just something you absorb when you live with a forest*.

In the archives, I pulled out recipes from the box. Basswood-flower fritters. Young violet-leaf appetizers (fried, splashed with orange juice and sprinkled with sugar). Plantain, mustard, and blackberry greens, boiled. Baked dandelion roots. Sumac-ade, sweet birch tea, Blue Mountain Tea. I had seen reference to Blue Mountain Tea before in Appalachian herbalism. It is made with *Solidago ordora*, a fragrant species of goldenrod. "Delicious hot or cold," Mellinger typed on the card. "Steep by pouring water over leaves until pale golden color."

There are cards that list entire menus, no doubt prepared for Mellinger's Incredible Edibles group. I pulled one labeled "Saturday dinner, Oct. 4, 1975." It listed a Qualla-mint cocktail, fried yarrow appetizers, chestnut soup (it must have been made with the nuts of the imported Chinese chestnut, as there were almost no wild American chestnuts left standing at that point), broiled chicken with an herb sauce, and dandelion greens.

Qualla refers to the reservation land of the Eastern Band of the Cherokee, some fifty miles to the north of where Mellinger lived in North Georgia, which had also been part of the wide Cherokee territory up until the 1830s. Perhaps she referred to a type of mint specific to that region and known colloquially as Qualla mint. References like these reflect the connections to Indigenous practices that run through the settler-colonial traditions of foraging in North America.

One of the earliest encounters with foraging that I remember was in the Great Smoky Mountains, the heart of the Cherokee homelands, where I grew up. As

my mother and I walked along a trail, we approached a man who had just put a twig into his mouth. He greeted us by reaching up to a branch to break off a small twig like his, and held it out to me, smiling. "Here ya go, chew on this—Indian toothbrush!" When I chomped down, its minty-green freshness winged through me like the flash of a cerulean warbler, vivid. Who were these "Indians" who invented such toothbrushes, I wondered, and what else could I eat that they did? Their presence loomed large in the mountains, in the names of plants like Indian cucumber (*Medeola virginiana*, with a crunchy, cucumber-like tuber), Indian strawberry (*Potentilla indica*, with an edible, though somewhat tasteless berry, of which I ate as many as I could find when young), and Indian banana (*Asimina triloba*, or pawpaw, North America's largest native fruit).

In such names we see both the presence and the erasure of Indigenous cultures. Another of Mellinger's menu cards is labeled, "Cherokee Atohuna Feast, 1978." It lists sumac-ade (brewed from the berry of what is considered one of the richest native sources of ascorbic acid, or Vitamin C, in Eastern forests, it is sour like lemonade), sliced artichokes, toasted nuts, chestnut soup, turkey-wild rice stuffing with greens, corn papas in corn husks, sorrel salad, persimmon-Indian pudding, and sassafras tea.

With a quick search, I learned that the Atohuna festival of the Cherokee was one of seven sacred festivals, held ten days after the new moon of October, which was itself celebrated as the new year. The Atohuna, or "friends made" festival, was a time when new friendships were honored with vows and old friendships were reconciled. What are we to make of this recognition of, and appropriation of, Indigenous culture within settler-colonial foraging traditions? When we eat the wild foods once eaten by Indigenous people who were dispossessed of the lands on which we forage, how can we, as descendants of settlers, or even as temporary visitors, honor the long lineages that preceded us while not appropriating them? How can an awareness of Indigenous histories call us to better stewardship?

In a scholarly article published in *Appalachian Journal* the year before Mellinger recorded her Cherokee Atohuna feast, she wrote:

The history of Appalachian medicine plants goes back far beyond the coming of the first white settlers. The Cherokee Adowahis (shamen), either male or female, knew and used over 600 plants.... All were gathered at the proper time of the year

We are called to honor the plants themselves and their growth in the wild as inherently and unimaginably valuable, over and above the archives of them.

with the proper chants and incantations. Barks, for example, were always gathered from the east or “spiritual” side of the tree. This same custom was later followed by the mountain settlers when gathering oak bark. They believed that bark gathered from the east side of the oak had more medicinal value, not realizing that they were still appeasing a Cherokee spirit.

As Cherokee were displaced and later removed from the region, remnants of their knowledge were carried on by settler-colonists and became suffused with Appalachian culture. Mellinger continued the article with a lament of the extreme overharvest of both ginseng and goldenseal, two of the most revered plants to the Cherokee. While part of the foraging traditions were preserved, along with the recognition of the plants’ “almost magical healing powers,” they were enfolded into a global capitalist economy that has almost completely eradicated the plants from the wild. “So many tons of [ginseng] have been dug up and exported to oriental markets,” wrote Mellinger, “that [the root] has become a rare and endangered species in many parts of the mountains.”

Dr. Clint Carroll, a citizen of the Cherokee Nation and associate professor of Native American and Indigenous Studies at the University of Colorado, says that reciprocity is the foundation taught to him

by the elders of his culture, and that non-Native foragers should ask themselves what reciprocity they are engaged in as they strive to establish connections to the land through foraging.

Mellinger wrote of the Cherokee conservation practices that had once ensured ginseng’s continued thriving: “The Adowahi would seek the plant in the fall of the year when the seeds were ripe, bypass the first three plants and dig the fourth, leaving its seeds, with red and white beads, in the hole for compensation. The Adowahi would ask permission of the mountain to take a piece of its flesh (the ginseng root).” For the Cherokee, the mountain as archive lent out its flesh by permission; the forest as *oikos* housed a botanical library that was the responsibility and living treasure-house of a rich human culture.

“Non-Native foragers might easily assume that Native people to the area where they’re foraging were once here and are no longer,” Carroll says. However, “They’re still here, and they still want to connect with lands that they were dispossessed from.” Awareness of Indigenous histories must be followed up with commitment to the current struggles of Native communities to connect with land and continue their traditions of stewardship. “Foragers must push themselves to not only acknowledge Indigenous absence but also work for land back for Native people.



Mellinger's photographs, held with her papers at the University of Georgia, preserve traces of her intimate relations with plants.

There are better futures, if we can think of how to enact them and realize them." Carroll worked to pass a plant-gathering agreement between the federally owned Buffalo National River and the Cherokee Nation in Oklahoma so that Cherokee people could continue traditional cultural practices of foraging that they are unable to on their limited tribal lands.

To honor the Cherokee lineage of land ethics, we are called to begin conversations about the rematriation of Indigenous lands. We are called to conserve forests and protect land, and to abstain from harvesting rare plants. I think of the locked vault in which the rare books are stored in the archives, the reverence with which we breathe as we leaf through the books, the care with which we turn the pages of seventeenth-century herbals like Culpeper's. Carroll tells me about the Cherokee tradition of foraging shagbark hickory nuts each fall for a soup called *kanuchi*. As I ponder seeking out the fallen hickory nuts later in the year, I want to carry the weight of Carroll's invitation to solidarity into the forest with me.

"It is our task to imprint this temporary, perishable earth into ourselves so deeply," wrote Rilke, "so painfully and passionately, that its essence can rise again 'invisibly,' inside us. We are the bees of the invisible. We wildly collect the honey of the visible, to store it in the great golden hive of the invisible."

We are called to honor the plants themselves and their growth in the wild as inherently and unimaginably valuable, over and above the archives of them. Mellinger criticized another Georgia botanist who found a grove of shooting-star (*Dodecatheon meadia*) and dug 60 "specimens" of it "to press between paper and send off to other botanists, who in turn might go out and decimate other colonies of other wild flowers in other places in order to return the favor."

In the *arkheion*, the house of the magistrates, we see "ark," which is not etymologically related, and yet it is visible there, and audible in "archive," conjured by it. The ark is the figurative place of refuge, a place where we store what might otherwise be lost. Storing pressed plants does not preserve them in the wild. Storing recipes of dishes made with wild edible plants does not preserve the tradition of foraging the plants, preparing the meals, and sharing them with others. The librarian and digital-humanities leader Bethany Nowviskie invites us to understand all collections, including those in natural-history museums, like pinned butterflies and honeybees, as "archives of the Anthropocene," "archives of diminishment."

What is the great golden hive of the invisible in which we store the visible honey? I pulled out cards from the recipe box and pored over them. Some of the cards don't contain recipes but rather a bit of lore or a folk saying about a plant. "Mustard, sunning in the field," says one, "had for the winter blind that brilliant quality of flaming sun." In Mellinger's scholarly article about the plants of Southern Appalachia, she wrote that plants "are gathered and brewed into slightly invigorating teas which seem to hold some of the distilled essence of rain and sunshine and take on an affinity with earth and sky."

Some of the cards have common plants, even ones considered invasive, pressed flat and Scotch-taped to them. There is a kudzu leaf, the leaf and flower of a dandelion, leaf of plantain. As I held the cards, tucked each back into its place, small bits of the plant material crumbled and fell onto the table or in the box, between the cards, miniscule gray-green flakes, like oregano spilled from a spice jar. Though all archives are vulnerable to the decay of time, these plant remnants made Mellinger's collection seem particularly fragile.

But then, the archive *is*, mostly, plant material: the pulped wood of trees pressed into thin pages, inked with symbols made by the hands of the once-living for a future generation to read. And for

most of written history, ink was made with walnuts, with oak galls. And the archives are stored within walls of wood: slices of the rings of trees, which are their own archives, dismantled so that they might house others.

I came across a black-and-white photograph of Mellinger walking through the woods, her head lifted to the forest canopy, and imagined what flicker of wings she may have caught sight of there, how the trees house invisible archives of songs handed down generation after generation. I imagined the bubbling swirl of a cerulean warbler's song. The light poured through the trees. The photograph did not indicate the photographer, but I imagined the person who was led by Marie that day through the woods and snapped her photo from behind—what plants they foraged, what meal they prepared later. Did they find a ruffled chicken-of-the-woods mushroom? Did they gather beech nuts? Did they stumble upon a lush growth of cress? A pawpaw growing on the creekbank?

In another photograph from a local newspaper, Mellinger walked in the lead with a group of people behind her, following along. Foraging walks were “the way for Mellinger to get her message across,” the caption read. Her message, in that particular article, was that she was worried “what the future holds in store” for her home. She worried about her home as archive, due to the lack of environmental education, the power company spraying pesticides, the Forest Service leasing land for timbering and extraction, the overdevelopment of her county.

Any meal can only be eaten once, as a man never steps in the same river twice, but this fact is particularly heightened by foraging. Every bite is the most potent imaginable distillation of the season, and each season lasts only a day. Every morsel is an unscrolling of the landscape in your mouth, the complex essence of the forest. You smell it, taste it, admire its color, its texture, hear yourself chewing it. It is the blossoming of a moment that now courses through your veins. It cannot be preserved, only savored as best as your senses will allow. *To imprint this temporary, perishable earth into ourselves so deeply.*

In the days after I visited the Mellinger collection, as March unfurled toward April, I roamed, my eyes turned down toward the ground, and up to the canopy. I saw the wild ginger growing and remembered last summer, when drought and heat had struck, and I fetched a bucket of water from the creek and poured it over the thirsty, wilting plants just feet away from the bank. The ginger had revived. I would not

harvest it. In the field I saw dandelions, hundreds of small blazing suns, stars of the daytime that closed at night. I filled a bowl with them, and the rounded leaves of violet that were everywhere, and the long lance-shaped leaves of plantain, a plant brought by Europeans that spread so rapidly from areas where it was planted it was called “white-man's footprint.” It is said to have gone westward ahead of white settlements, so that when it showed up, Indigenous communities knew that the colonizers would arrive soon. We forage from a cultural archive and eat from our legacies and lineages of relationship to the land. I will never taste an American chestnut. I will never dig a ginseng root. I eat what's abundant, avoiding roadsides where herbicides are sprayed.

Ecology, the study of the *oikos*, is a study of relationships. It is the study of the complex web of home, its weave of stories, histories, and species. This, to my mind, is the great golden hive—this vast net of the world. The untraceable path of bee to blossom, the bee's dance, the untold zillions of paths to nectar. The link from hop-hornbeam catkin to cerulean warbler, from chicken-of-the-woods mushroom to red-oak root, mycelial thread to beech grove, creek to cress, fungus to chestnut, chainsaw to ginger, mower to clover, individual to community, forest to frying pan, present to future, hand to earth, mouth to seed.

I sautéed the greens and made bite-sized pies with them. Three friends came over, and we ate them on the hillside in the late afternoon sun. It was dogwood winter, a cold spell, and we huddled together in our jackets, the chilling wind biting at our necks. We chewed, closed our eyes to taste the moment that was a season in itself—savored it, as best we could. To imprint such a perishable earth into ourselves so deeply. 🌿

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Magnolia Gardens

By Amy Lowell (1874–1925)

It was a disappointment,
For I do not like magenta,
And the garden was a fire of magenta
Exploding like a bomb into the light-colored peace of a spring afternoon.
Not wistaria dropping through Spanish moss,
Not cherokees sprinkling the tops of trees with moon-shaped stars,
Not the little pricked-out blooms of banksia roses,
Could quench the flare of raw magenta.
Rubens women shaking the fatness of their bodies
In an opulent egotism
Till the curves and colors of flesh
Are nauseous to the sight,
So this magenta.
Hateful.
Reeking with sensuality,
Bestial, obscene—
I remember you as something to be forgotten.
But I cherish the smooth sweep of the colorless river,
And the thin, clear song of the red-winged blackbirds
In the marsh-grasses on the opposite bank.

AMY LOWELL was born in Boston in 1874, and turned to poetry in 1902, becoming a major figure in the early twentieth-century's imagist movement. "Magnolia Gardens" was published in the December 1922 issue of *Poetry* (vol. XXI no. III).



ANNALS OF ARBORICULTURE

My 'Minuta' Mea Culpa

By Peter Del Tredici

While North American horticulturists have been selecting and growing dwarf conifers since the mid-1800s, they did not become widely available to the gardening public until the 1960s when specialty nurseries began expanding their offerings to meet an increasing demand for unusual plants. The writings of serious collectors such as William Gotelli of New Jersey and Helen Bergman of Pennsylvania played an important part in introducing people to dwarf conifers. The eastern hemlock (*Tsuga canadensis*) was a major player in this emerging field because of its propensity to generate mutant forms.

My interest in hemlock cultivars began in 1979 when I met Gus Kelley of Little Compton, Rhode Island, shortly after I started working at the Arnold Arboretum. Gus was a dwarf conifer enthusiast who had started his own horticultural publishing house, Theophrastus, in the

Above: *Tsuga canadensis* 'Minuta' (1497-71*A) in 1983, 12 inches high by 15 inches wide at 12 years of age.

Opposite: *Tsuga canadensis* 'Minuta' (955-70*A) in 2022, 39 inches high by 50 inches wide. It was one inch tall when it was received from Joel Spingarn in 1970 under the name 'Pygmaea'.





FIG. LXXXIX.—TSUGA CANADENSIS MINUTA (p. 274)



Abbott's Pigmy Hemlock. *Tsuga canadensis minima*.
Arriving in a strawberry box.

Top: *Tsuga canadensis* var. *minuta* from Teuscher's 1935 article in the distinctive strawberry box that George Ehrle received it in from St. George.

Bottom: The same plant from a different angle misidentified in Jenkins' 1948 article as "Abbott's Pigmy Hemlock." The plant is 4.5 inches tall by 5 inches across.

early 1970s. He published my book about Sargent's Weeping Hemlock—*A Giant Among the Dwarfs*—in 1983, and a year later, my second hemlock book, *St. Georgie and the Pygmies: The Story of Tsuga canadensis 'Minuta'*. In both cases, I tried to sort out the contradictions in the literature regarding the origins of these plants, but the process turned out to be much more complicated and time consuming than I ever imagined. Indeed, it took me forty-two years and three tries to finally nail down the history of Sargent's weeping hemlock, and the article you're reading now is a revision of my thirty-nine year old book about the 'Minuta' hemlock.

The Dwarfest of the Dwarfs

The cultivar 'Minuta' is a true genetic dwarf consisting of several morphologically indistinguishable clones. It is a slow and steady grower—never more than an inch a year and often half as much—and shows no tendency to “revert to type” the way many dwarf conifers do. Its congested foliage lacks measurable internodes and, over time, forms a dense dome of foliage that's a perfect fit for any rock garden. The oldest specimen of the 'Minuta' hemlock that I am aware of is at the Arnold Arboretum. It was one inch tall in 1970 and was 39 inches high by 50 inches wide in 2022—for an average height increase of 0.65 inches and a width increase of 0.94 inches per year.

'Minuta' was introduced to the horticultural world in 1935 by Henry Teuscher of the New York Botanical Garden, who published a description of the plant based on information and a photo provided by George L. Ehrle, a nurseryman from Clifton, New Jersey. In his article, Teuscher reported that the plant had been discovered in Vermont in 1927 by an unknown person who not only collected some twenty-five dwarf seedlings over an eight-year period but also discovered their purported parent that was two feet tall and producing cones. Teuscher used the Latin-form botanical name, var. *minuta*, to describe the plant because “this variety breeds true from seeds.”

The complete story of 'Minuta's' origin—including the name of its discoverer—did not emerge until four years later in John Swartley's Cornell University Master's thesis, *Canada Hemlock and Its Variations* from 1939. His full entry for *T. canadensis* var. *minuta* reads as follows:

This plant which is probably 25–35 years old, was collected near Charlotte, Chittenden County, Vermont, and is now growing in the rock garden of George L. Ehrle, Clifton, New Jersey. The following

story has been gleaned from correspondence between Mr. Ehrle and Daniel M. St. George of Charlotte, Vermont, the finder of this interesting strain of Canada hemlock.

Several years ago, a Mr. Craig informed Mr. Ehrle of the existence of this very dwarf strain and Mr. Ehrle at once investigated the possibility of acquiring a specimen. He was informed that there were two plants available at five dollars each so he quickly ordered these and they were received September 10, 1934. Mr. St. George reported that they had been dug in 1927 on the north slope of the Green Mountains, at a rather high altitude in a small open area with normal hemlock growing on all sides. Mr. St. George dug some small plants in 1931. In 1934, he again visited the site and collected another lot of plants and found the parent which was about two feet high and very dense, just like the small ones. It was standing beside a maple tree, crowded one side by a spruce, but it was bearing cones and seedlings were distributed within 150 feet. This plant must have been more than 50 years old. In the spring of 1935, another visit was made but the place had been so closely grazed by cattle that not a single plant like the other could be found and even the parent was dead. However, Mr. St. George reported digging two faster-growing plants 4 feet high and observing several more with similar foliage.

Mr. St. George transplanted all of these dwarf hemlocks to his small nursery, shading them only the first year. He stated that they were easy to establish and very hardy. Altogether, he dug and sold 25 to 30 plants, but with the exception of Mr. Ehrle, he has no record of the identity of his customers.

Mr. Ehrle used one of the small plants to supply scions for grafting, but without success. The other plant is not thriving, but some cuttings have been successfully rooted by Mr. Ehrle, therefore this strain will not be lost. This plant was used by Teuscher in describing var. *minuta*, therefore it is unquestionably the type plant of that variety.

Unfortunately, Swartley's thesis was never published, so St. George's role as the discoverer of 'Minuta' was not widely recognized until 1965 when two Dutch authors, P. Den Ouden and B. K. Boom, excerpted it for their entry on *Tsuga canadensis* in their *Manual of Cultivated Conifers*. During this twenty-six-year gap, the history of 'Minuta' became hopelessly entangled with the very similar cultivar, 'Abbott's Pigmy'. The main sources of this confusion was none other than Charles F. Jenkins, the founder of the Hemlock Arboretum in Germantown,

For whatever reason, Jenkins and Teuscher seemed intent on erasing Daniel St. George from the history of 'Minuta'.

Pennsylvania, and the author of the *Hemlock Arboretum Bulletin* at "Far Country", published quarterly between 1932 and 1951. In the October 1933 issue, Jenkins talked about visiting Frank Abbott, a noted plant collector, at his summer home in Athens, Vermont. Among the various mutant hemlocks growing in the nursery, Jenkins described "a dwarf pincushion which he had gathered on the hills on the south bank of the Winooski River, in Richmond." In his 1939 thesis, Swartley described the same plant as "very similar" to Teuscher's *T. canadensis* var. *minuta*, but with leaves arranged more horizontally than radially. He also reported that Abbott had collected his plant north of Richmond "on the west side of the Winooski River, on the same ridge of mountain as Teuscher's [plant], and only about 10 miles away."¹

In the April 1948 issue of the *Bulletin*, Jenkins announced that the plant he had described as a "dwarf pincushion" in 1933 should now be called "Abbott's Pigmy Hemlock." Unfortunately, the photo that went with the article was not of Abbott's plant but of the plant St. George had sent Ehrle fourteen years earlier in its distinctive strawberry box. In the next issue of the *Bulletin*, Jenkins published a long article in which he owned up to his mistake with the photo but then omitted a crucial part of the plant's

history by failing to mention St. George. This was a particularly glaring omission given that he specifically thanked Swartley for his help in preparing "this explanation and correction."

A year later, Henry Teuscher burst through the door that Jenkins left open with his own article about "Abbott's Pigmy Hemlock" that asserted that Frank Abbott was the one who actually discovered the botanical oddity in Vermont in 1927 and sold plants to George Ehrle in 1934. For whatever reason, Jenkins and Teuscher seemed intent on erasing Daniel St. George from the history of 'Minuta'. Why they chose to do this will never be known, but it could well have been to protect Abbott's reputation—either because he didn't want to admit that he purchased his pygmy hemlock from St. George or poached it from his secret collecting location.

The confusion surrounding 'Minuta' was exacerbated by the emergence of a second lookalike hemlock called 'Pygmaea' in the 1940s. The history of the plant was described by Joel Spingarn who had propagated a specimen "from a single cutting generously given to him by Mr. William Gotelli" in 1959. According to Spingarn, Gotelli got his 'Pygmaea' from Henry Hohman, who got a plant from Joseph Gable in 1941, at which point the trail went cold. Based on the two

plants growing in his garden, Spingarn asserted that ‘Pygmaea’ could be distinguished from ‘Minuta’ by virtue of the fact that it grew much more slowly.

My own research at the Arnold Arboretum on the growth rate and needle length on three plants of ‘Minuta’ and two of ‘Pygmaea’ (including one from Spingarn) showed that the differences between them were insignificant and better explained by phenotypic responses to environmental conditions than by genetic variation. I went on to postulate that ‘Pygmaea’ was probably just a synonym for ‘Abbott’s Pigmy’ and recommended that all three plants—which were hopelessly confused in the nursery trade—be lumped under the cultivar name ‘Minuta’.²

A Visit With Daniel St. George

This is where things stood in 1984, when I published *St. George and the Pygmies*. In the book, I reported visiting the 91-year-old Dan St. George at his home in Charlotte, Vermont on April 11, 1981. I had decided to go there because, amazingly, none of the parties who had written about ‘Minuta’ had actually talked with him about his discovery and I wanted to get the story directly from him. Shortly after my arrival, Dan took me outside to show me three “dwarf” hemlocks growing in his yard that he had collected—one was a dense pyramid about ten feet tall and the other two were narrow and sparsely branched and about eight feet tall. I was disappointed that none of them looked like ‘Minuta’, so I showed him the picture of George Ehrle’s strawberry box specimen from Teuscher’s 1935 article and asked him if he had ever collected something like this. He looked the image over carefully and said he never found anything that looked like that plant. I pressed him further, but he stuck to his story, stating that he and his partner, Larry Root, discovered a number of dwarf hemlocks in Richmond, Vermont on the east side of the Winooski River, just beyond where Route 2 crossed over an old iron bridge, in a wet area behind the so-called “checkered house.”³ They collected thirteen hemlock in 1928, including the two narrow, sparsely branched plants in his yard. In 1932, he returned to the site and dug a fourteenth plant that grew into his dense pyramid.

The only person who St. George told about the Winooski River site was his good friend, Fred Abbey of North Ferrisburg, Vermont, who, like St. George, was a breeder and grower of lilies. While St. George denied knowing George Ehrle, he did say that he knew William Craig, of Weymouth, Massachusetts, the man whom Swartley credits with telling Ehrle

about St. George’s dwarf hemlocks. Craig, it turns out, was a lily expert and a friend of both St. George and Fred Abbey. So lilies seem to be the glue that holds the ‘Minuta’ story together—St. George told Fred Abbey about his hemlocks who told William N. Craig, who told George Ehrle, who told Harry Teuscher.

While I didn’t realize it at the time, the collecting location that St. George told me about was just across the river from where both Jenkins and Swartley said that Frank Abbott had collected his pigmy hemlock—a coincidence that suggests Abbott might have heard about the site from one of St. George’s horticultural buddies. Regardless of whether it was on the east or the west side of the river, it’s a flat area that in no way can be considered the “north slope of the Green Mountains, at a rather high altitude” where St. George told Ehrle he had collected his ‘Minuta’ seedlings.

A couple of weeks after my visit, I sent St. George a questionnaire about his hemlock collecting activities just to make sure I had gotten the story straight. The survey included two specific questions about George Ehrle and he returned it to me with the clear answer that he did not know him. He also denied collecting anything that looked like ‘Minuta’. In an attempt to make sense of his denial in my book, I speculated that, “St. George’s memory could have become clouded during the more than 50 years that elapsed between the actual discovery of the plants and my interview with him.” I didn’t really believe this, so I proposed instead that Swartley’s version of the story was based on conversations with George Ehrle rather than letters from St. George. How wrong I was.

Mea Culpa

When my book came out in 1984, it was pretty much ignored by everyone who wasn’t a fanatic dwarf conifer collector. Later that same year, John Swartley published an updated version of his 1939 thesis under the title, *The Cultivated Hemlocks*, with revisions by Humphrey J. Welch. In his book, Swartley stuck to the ‘Minuta’ story described it in his thesis, which pretty much wiped out any traction that my version of the story might have generated.

Such was the state of affairs until February 17, 2006—twenty-two years later—when, out of the blue, I received an email from Paul B. Plante II who had purchased St. George’s house and all its contents in 1984, a year after his great uncle Dan had died. In his email, Paul told me that he had seen my book and had another piece of the puzzle for me to ponder,

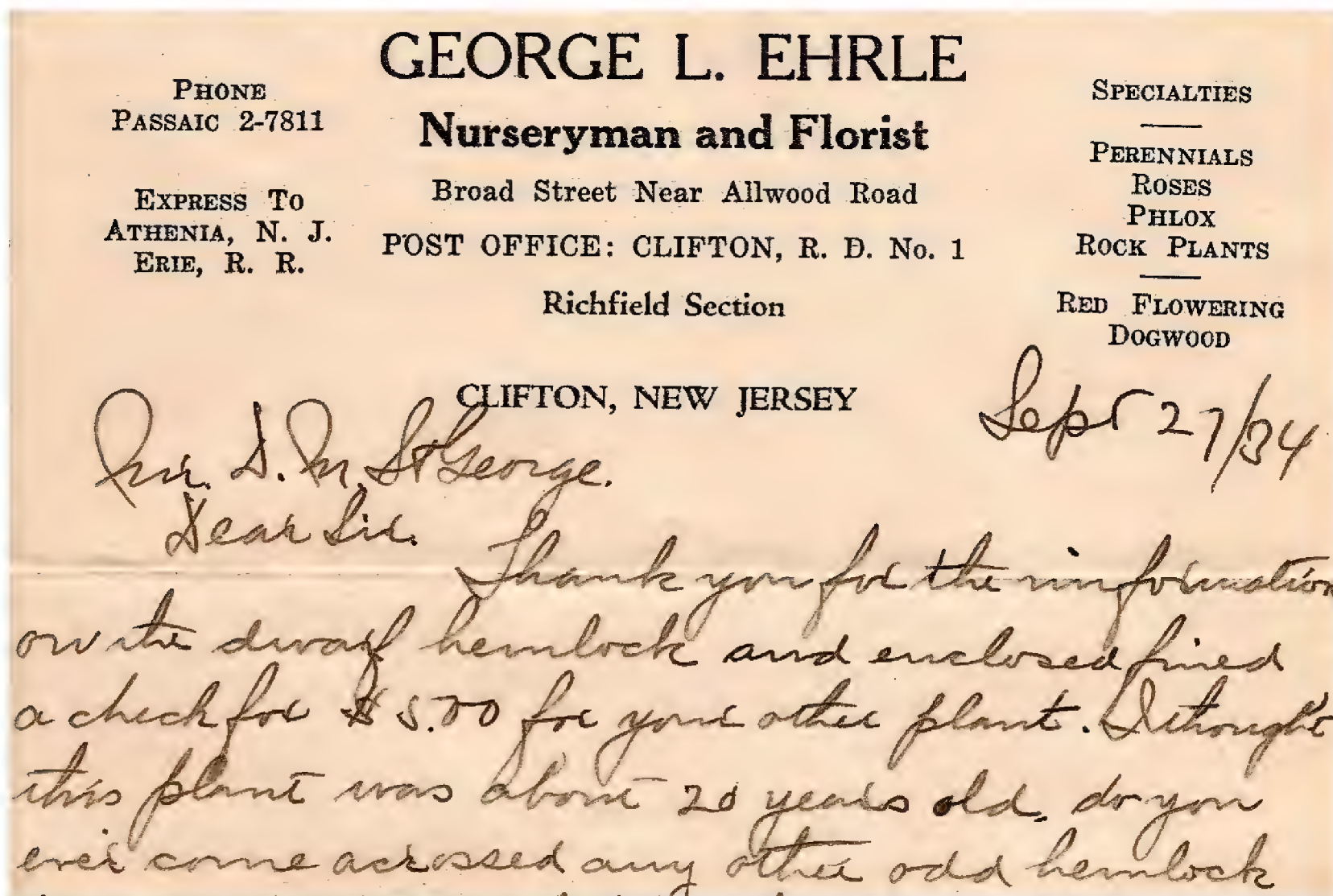
Letters clearly prove that Daniel St. George discovered *Tsuga canadensis* 'Minuta'.



Above: Daniel St. George in April 1981 with the ten-foot-tall, dense pyramid hemlock he collected in Richmond in 1932. It was still “alive and kicking” in 2023.

Opposite: Daniel M. St. George (1890–1983) relaxing at home in Charlotte on April 11, 1981; *Tsuga canadensis* 'St. George' (1707-81*A) at the Arnold Arboretum, photographed in 2020 when it was 16 feet tall by 12 feet across and 39 years old.





One of the letters to Daniel St. George from George Ehrle, dated September 27, 1934, acknowledging the receipt of his second dwarf hemlock

“On page 20 of the book, you state that Uncle Dan denied knowing George Ehrle or ever having corresponded with him. As you posit on page 21, it does indeed seem that Uncle Dan had a lapse of memory ... I found no less than 13 letters from Mr. Ehrle on his letterhead, and 2 penny postcards. Below is a link to a high res scan of a letter thanking Uncle Dan for the ‘dwarf hemlock’ on Oct 6/34.” As far as I can tell, I never answered Paul’s email, but I did download the scan of letter he attached.

The matter rested here—unresolved—until December 2022, when I started work on a project about another of my favorite hemlock cultivars, ‘Cole’s Prostrate’. In going through various hemlock images on my laptop, I came across the letter from Ehrle to St. George, but I had no idea where it came from. I typed “St. George” into the search box on my email account and at the bottom of the results list was the 2006 message from Paul Plante with the attached copy of the Ehrle’s letter. With Google’s help, I got in touch with Plante, who took no offence at the fact that I was answering his email sixteen years late. He would be more than happy to send copies of the letters to George Ehrle, provided he could remember

where he had put them. To my amazement, I got an email from him two days later letting me know that he had found the letters and would send me scans.

Below are excerpts from eleven of the fifteen letters from Ehrle to St. George that relate to the discovery and distribution of ‘Minuta’. The first one is dated August 17, 1934 and the last one, November 13, 1935—a span of nearly fifteen months:

Aug 17, 1934: “Mr. Wm. N. Craig of Weymouth was at our Nursery today and told me had seen at your nursery a dwarf form of hemlock ... Would be glad to get a plant of your dwarf variety. What is your price for these.”

August 24, 1934: “Enclosed find \$5.00 for which send me one of your dwarf hemlocks so I can see what this plant looks like.”

September 19, 1934: “Your dwarf hemlock arrive in good condition.”

September 27, 1934: “Thank you for the information on the dwarf hemlock and enclosed find a check for \$5.00 for your other plant ... I should like to have a picture of the parent plant. How old do you think it is. Would it be possible to get a few grafts of the old plant in the winter. Let me know when you go to get

“Let me know when you go to get some of the other small ones. As I should like to buy one the size of a thimble.”

some of the other small ones. As I should like to buy one the size of a thimble.”

October 6, 1934: “I received the dwarf hemlock in good condition on Thursday ... You mentioned the only time you could find these was in spring. When you go I wish you would collect a small branch with a cone on it. What would you ask for the old plant. It may be found or destroyed by some one.”

October 17, 1934: “About a week ago I wrote in regards to the small hemlock. You see this plant can’t be propagated either from cuttings or grafts. As they are so small therefore I am so anxious in getting a few more plants ... When you go to get the other small plants next spring let me know and if your price is not too high I will take all you can spare.”

November 7, 1934: “Would gladly pay you \$25.00 for the old plant if you ever care to sell it.”

December 13, 1934: “If you could transplant the old plant and grow it in the nursery for one year, I would give you \$75.00 for it. The first one I got from you is more compact than the last one. It is the last one I like best because of its irregular growth. I take it from your letter that both of these are from the 1927 collected trees.”

February 28, 1935: “Why I am anxious to get this plant is for my collection because it is the original plant. I would be willing to give you all the seed it produces every year. If you would not care to sell it, perhaps some time you could let me have a few grafts.”

March 2, 1935: “I note what you said about the hemlock. If it is growing among the roots of other trees be careful and don’t take any chances. If that should be the case it would be better to root prune the plant for one year. Another question how close does this dwarf grow to other hemlock. It seems that the seeds self pollinate it otherwise there would be a greater variation among the plants.”

November 13, 1935: “Should you go in the neighborhood where you got the small hemlock from I hope you may be able to find a few plants. It is too bad I did not learn sooner that you had these. I would have bought every one from you and the old plant too. I would have made a special trip to get it. Should you not be able to find any would be kind enough to see if any seed pods are on the old plant, these are not good. I wanted to see the size of them and also get a part of the trunk only a small section say 6 inches or it.”



Daniel St. George in the doorway of his house in Charlotte, Vermont, on April 11, 1981.

These letters clearly prove that Daniel St. George discovered *Tsuga canadensis* ‘Minuta’ and that Swartley’s thesis description of the plant’s origin was based on the letters St. George sent to Ehrle. Another thing that stands out in the correspondence is Ehrle’s intense interest in the old cone-producing plant and his repeated, but futile, efforts to get St. George to sell it to him. According to Swartley, St. George discovered the supposed parent in the spring of 1934, but a year later, “the place had been so closely grazed by cattle that not a single plant exactly like the others could be found and even the parent was dead.” In his last letter, Ehrle clearly knew the plant was dead when he asked St. George to send him a section of the trunk, presumably so he could count the rings.

Despite its death, mystery still surrounds the cone-producing parent—namely that none of its offspring, after nearly a hundred years of cultivation, have ever been reported to produce seed. This includes the fifty-two year old specimen at the Arnold Arboretum that is over three feet tall as well as the one that Harold Epstein of Larchmont, New York, obtained from George Ehrle in the 1940s that was 18 inches tall by 22 inches wide in 1983. The sterility of cultivated specimens of ‘Minuta’, as well as his reluctance to provide Ehrle with any hard evidence of its existence raises some doubts about St. George’s claim that he had found the actual parent of the seedlings he sold to Ehrle. In my opinion, the most likely explanation is that the seedlings originated from cones produced by a witch’s broom on a nearby, normal hemlock.⁴

From start to finish, the story of ‘Minuta’ is a comedy of errors, including my own. Nevertheless, I’m pleased to report that when I asked St. George to send me cuttings from the dense, pyramidal hemlock in his yard, he generously agreed to do so. They arrived at the Arnold Arboretum on December 3, 1981 and I stuck them under a polyethylene tent in the greenhouse. Only one cutting from this accession survived to which I gave the cultivar name ‘St. George’. Forty years later, it has matured into a sixteen-foot tall monument to the man who discovered one of the truly great dwarf conifers. 🌲

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ENDNOTES

- 1 This statement is based on the mistaken assumption that Ehrle’s var. *minuta* had been collected “near Charlotte” because that’s where Daniel St. George lived.
- 2 According to the *International Code of Nomenclature for Cultivated Plants*, 9th ed. (Brickell et al., 2016), “An assemblage of individual plants grown from seed derived from uncontrolled pollination may form a **cultivar** when it ... can be distinguished consistently by one or more characters even though the individual plants of the assemblage may not necessarily be genetically uniform.” (Article 2.12)
- 3 The checkered house is still there and its name refers to the diagonal, checkerboard pattern of its red and black bricks.
- 4 Seedlings produced by witches’ brooms are the source of many of the dwarf conifers. They are common in Pinaceae genera and Waxman (1975) has documented them in eastern hemlock.

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How to Climb and Grow Stronger: Lessons from Ornamental Wisterias

By Israel L. Cunha Neto and Joyce G. Onyenedum

Among plants, growth forms vary from tiny herbs and woody shrubs to climbing vines and charismatic tall trees. A tremendous amount of research has uncovered the fundamentals of how trees gain their massive stature and thick stems. This process, called “secondary growth,” generates both xylem (wood) and phloem (inner bark) through active cell divisions in the trunk each growing season, which progressively builds the width of a tree. Secondary growth is a critical process in plant growth and development. It provides mechanical support for the growing crown and a continuous vasculature system to transport water and nutrients from the depth of the soil to the most juvenile leaves at the top of a tree. Historically, our understanding of secondary growth was restricted to careful observation of cells and tissues under the microscope, however with advancements in technologies came advancements in science. Today, we have sequencing technologies that harness the power to pinpoint exactly which genes in the DNA of plants control secondary growth. Most research in this area focuses on trees. But trees are not the only plants that undergo secondary growth.

Indeed, climbing woody vines, known as lianas, also generate secondary growth, although in highly modified fashions. In contrast to trees that form a ring of xylem surrounded by phloem, an unusual organization of these vascular tissues can be found in the stems of many lianas—which range from cylindrical stems with assorted distribution of xylem and phloem to asymmetrical and/or lobed stems. Why do vines have such unusual stem architecture? Scientists hypothesize that these alternative anatomies promote increased stem flexibility, mechanical support, and water/sugar translocation, contributing to the vine’s ability to climb up a supporting tree in the forest or a backyard trellis. But how

Wisteria frutescens in the Arnold Arboretum’s Leventritt Shrub & Vine Garden. All photographs courtesy of Israel L. Cunha Neto



do these complex patterns develop? In our research, we aim to answer this question by investigating the genes controlling the unusual secondary growth of vines.

To answer these research questions, we are studying plants growing at the Arnold Arboretum of Harvard University and across the “Ag Quad” in the College of Agriculture and Life Science at Cornell University. We collect the stems of lianas, with the aim of understanding how their secondary growth differs from trees; therefore, we focus our investigations on the “vascular cambium”—a self-perpetuating group of cells (also called a “meristem”) that creates the complex conduit-like system formed by xylem to transport water and phloem to sugars. Both xylem and phloem are known as complex tissues as they are made up of more than one type of cells. These cells work in a harmonized manner to perform various functions, including water and nutrient transport, storage, and mechanical posture. In woody plants, when produced by the cambium they are called secondary xylem and secondary phloem, which comprise the wood and inner bark, respectively. The cambium is responsible for the bulk of radial growth in the large trunk of an oak tree or the robust stem of a climbing woody vine. To further our understanding of how the vascular cambium generates radial growth, we are employing an integrative approach combining developmental anatomy (morphology) and developmental genetics (molecular biology) through comparative transcriptomes—a method that generates a profile of all active genes during the collection of this biological sample. Therefore, this genetic approach will reveal the genes that are involved in the formation of the vascular cambium, illuminating the potential regulators that uniquely initiate diverse arrangements of vascular tissues that we observe in nature. Such studies are critical not only to comprehend the immense vascular diversity of woody plants, but also to understand how wood is formed, the very tissue that humans depend upon for construction, fuel, fire, and so much more. To study radial growth, many scientists have used model plants such as thale cress (*Arabidopsis thaliana*), eucalyptus (*Eucalyptus grandis*), or poplar (*Populus* spp.) (Tonn & Greb, 2017). Instead of trees and shrubs with the typical mode of radial growth that is observed in most woody plants, we opted for an unconventional approach, studying a group of woody vines with special morphological traits, the wisterias.

Why Wisterias?

“Wisteria” is both the common and scientific name of a small group of plants within the legume family. These twining woody vines are captivating ornamentals grown in gardens all over the United States. Landscapers, artists, and plant lovers value them due to their generous bloom, large flower clusters, various colors, and fragrance. Currently, only four species are recognized in the genus *Wisteria*, one being native to the US (*W. frutescens*) (Compton et al., 2019). All other species occur naturally only in temperate zones of China, Japan, and Korea (Compton et al., 2019).

Wisteria species can be identified by vegetative features including the size and number of leaflets—however reproductive characteristics such as type/position of inflorescence, length of flower clusters, or timing of blossom are more critical for identification (Compton et al., 2019). Surprisingly, flower color is not one of the most important features, as different species may have flowers of the same color. Similarly, some wisterias may be identified by looking at the direction that the plants twine. Chinese wisteria (*Wisteria sinensis*) and American varieties (*W. frutescens*) normally twine counterclockwise. Japanese wisteria (*W. floribunda*) grows clockwise.

Another interesting feature of wisterias is the way they achieve radial growth. Most woody plants produce a single solid mass of xylem surrounded by a continuous coating of phloem. However, wisterias climb and grow strong through the formation of multiple increments of xylem and phloem formed in a successive fashion, similar to beetroots or stems of mangrove trees. This phenomenon is called “successive cambia” and originates through the formation of a new vascular cambium that arises in an unusual position (ectopic) repeatedly. These additional vascular increments, which in some cases are concentric and continuous, are not the same as “growth rings”—the seasonal increment of xylem cells (i.e., wood only) with distinctive features (e.g., size, shape) which allow researchers to demonstrate the age of trees. New increments of successive cambia (wood + bark) are usually not annual, and not seasonally dependent; they may be associated with various functional adaptations in plants, including storage in the sugar beets or else an adaptation that maximizes the transport of water, mechanical resistance, and flexibility not only in wisteria but in several tropical woody vines. If you live in temperate regions such as the northeastern US, it is likely that no other plant with successive cambia besides wisteria is present in your

Because wisterias are such charismatic woody vines that naturally grow in temperate zones, we selected them as a biologically interesting system.

garden or in the city park. Most woody plants exhibiting this type of radial growth occur in subtropical and tropical environments, distributed across different botanical families, generally including climbing plants (vines, climbers, twiners).

Because wisterias are such charismatic woody vines that naturally grow in temperate zones, we selected these plants as a biologically interesting system to investigate how successive cambia evolved within the seed plants. Over millions of years in the evolutionary history of vascular plants, the vascular cambium has remained conserved in most plant lineages, demonstrating its key biological function (e.g. hydraulic and mechanical properties). Because this vascular cambium is biologically similar in most plant lineages including in plants with and without successive cambia, this research will shed light not only on how wisteria grow by means of multiple vascular increments of successive cambia but will also contribute to the understanding of how large trees with the typical mode of secondary growth expand their large trunks, producing most of the woody biomass in nature.

In Search of the Perfect Wisteria

To investigate these questions on radial growth and the climbing habit, our original plan was to work with the American wisteria (*Wisteria frutescens*). That

plan did not prove practical, as they are rather hard to find in nature and are not as vigorous (and showy) as the Asian species (Wyman, 1949). Slender plants are usually not satisfactory for this investigation since successive cambia in wisterias appear after several years of normal growth (Nejapa et al., 2021), with stem diameter larger than 2 to 3 centimeters. We then discovered the notable collection of wisterias at the Arnold Arboretum of Harvard University in Boston, which includes dozens of wisterias from all different species. This research was proposed to the Arboretum, and we were honored to receive the 2022 Sargent Award, which granted us the opportunity to collect wisterias (and other plants) in the Living Collection.

For botanists in temperate zones, summer is a special time for fieldwork. It was still early in the season when we went to the Arboretum to check on some of the eighteen accessioned American wisterias listed as being in “good” or “fair” condition. Most of these plants are displayed at the Leventritt Shrub & Vine Garden, where wisterias stand along with numerous other spectacular woody vines. These American wisterias were also slender and most likely without successive cambia, similar to some plants we had observed at Cornell University. Still, we examined the branch of one plant (359-2003*C), approximately 2 centimeters wide, growing up one of the trellises. We confirmed our expectations on the absence of



Views of *Wisteria floribunda*: collected from Cornell (top left), ectopic vascular meristems in concentric increments of xylem and phloem (successive cambia); from the Arnold Arboretum (top right), a disc of stem showing initial ectopic cambia (arrow) sourced from a plant (1894-77*A) along the Arnold Arboretum's Valley Road (bottom).

successive cambia. Collecting large wisteria stems with successive cambia often involves cutting stems at the base of the plant. Such collecting practices are destructive, as these branches may be responsible for most if not the entire aerial plant body. Given this preliminary observation on *Wisteria frutescens*, we couldn't risk collecting more plants at the Leventritt Garden, as collecting must be done in a way that does not impact the general public's experience of the Arboretum. Our misfortune with American wisteria turned our collection sampling upside-down. Our next steps required some sleuthing—both historical and botanical. We had to turn our investigation towards one of the other Asian species. But which one was the most appropriate? We located a large Japanese wisteria (*Wisteria floribunda*) at the Arboretum. Michael Dosmann, the Keeper of the Living Collections, allowed us to collect a robust stem from the plant, which is an original *W. floribunda* brought from Japan after an expedition in 1977 (1894-77*A). The larger branch from this plant was 50 mm wide. We noticed that successive cambia were present in this branch, which gave us the opportunity to collect our first sample to investigate the genetics underlying the formation of successive cambia. This shows the importance of having diverse plant species in the Arboretum collection and the efforts of early Arboretum investigators to acquire them. However, we needed to find other samples of *Wisteria floribunda* because transcriptomics—the genetic approach used in our study—requires at least three to six separate specimens. Moreover, large stems with secondary growth are critical to investigate and understand stem anatomy of plants with successive cambia. From the plants growing in the Arboretum, we also noticed that, during that summer, only American wisterias had flowers—which may be related to phenology (age of the plant), seasonality (weather conditions) or horticultural practices (pruning). Flowers, however, provide useful information when trying to identify a plant species—and we would need as much information as possible to identify other *W. floribunda*.

Wisterias in Ithaca and Cornell University

Collecting only one specimen with successive cambia at the Arnold Arboretum made us return to Ithaca in search of more plants. Back in Ithaca, we discovered potential Asian wisterias in three different locations: one plant growing in the Ithaca Commons (downtown), seven to eight plants at A.D. White House

(Cornell University), and another population on Cornell's West Campus. The Cornell Botanic Gardens had one American (*Wisteria frutescens*) with flowers and two Chinese wisterias (*W. sinensis*) without flowers, but no Japanese wisteria (*W. floribunda*). These plants grow over a trellis ornamenting the Nevin Welcome Center. The wisterias growing at A.D. White House and on West Campus were accessible plants that could greatly complement and facilitate our research sampling. However, no one on campus knew the exact species identification of these plants.

How to Identify the Wisterias?

Since there were no flowers on the plants growing in Ithaca, getting a positive identification was our next mission. Examining the direction in which stems twine can narrow the species ID, but is not definitive, as multiple species twine in either given direction. By corresponding with James A. Compton, we also learned that in wisterias this characteristic is not conserved in cultivated species—a reason their paper did not use this feature in the key to identify species (Compton et al., 2019). Among climbing plants in general, it is known that the majority of species (>90%) are right-handed (counterclockwise) (Edwards et al., 2007) which is most likely genetically determined (Smyth, 2016). Notably, Wyman, a former horticulturist at the Arnold Arboretum, reported that "... in the case of *Wisteria floribunda* two plants of more than a dozen examined were found that twined in the opposite direction from the majority of this species" (Wyman, 1939), which highlighted the problem to identify wisteria species based on their handedness.

During the summer, as we were exploring the identification of wisterias, we also investigated the history of the plants growing on the Cornell Campus. We found that plants growing on West Campus were catalogued neither by Cornell Botanic Gardens nor by the Grounds Department of Facilities and Campus Services, which is responsible for landscaping. Indeed, there were wisterias near the parking lot between University and Stewart Avenue, but no one knew how they ended up there, let alone their species identification. While trying to dig out information about this locality, we simultaneously sought to learn more about the collection of wisteria growing at A.D. White House. Through conversations with numerous people and resources at Cornell, we began to learn not only about wisterias but also gained glimpses of the fascinating history surrounding horticultural plantings on campus.



Wisteria floribunda growing from right to left at A.D. White House, Cornell University (left) and *Wisteria frutescens* growing from left to right at the Arnold Arboretum (right).

A.D. White House: the Presidents, the Garden, and the Wisterias

The A.D. White House is a mansion located in the heart of Cornell’s campus. The house is named after Andrew Dickson White, Cornell University’s first president and co-founder. It served as the residence for Cornell University presidents from 1872 to 1949. Today, it is part of the College of Arts & Sciences, housing the Society for the Humanities (Cornell University, 2022). The garden surrounding the house was designed primarily by the fourth president’s wife, Margaret Livingston Farrand—popularly known as Daisy—who had a “serious interest in horticulture” and “the reputation of a highly skilled and distinguished amateur gardener” (Szekely, 2015). Not only an important figure in Cornell’s life, Margaret Farrand was also sister-in-law to Beatrix Farrand—known as one of the first and most celebrated landscape architects in the United States, responsible for many private and institutional gardens in the United States. Notably, Beatrix Farrand had a deep connection with Charles Sprague Sargent, the first director of the Arnold Arboretum (Beatrix Farrand Society, 2020). Unfortunately, no details were found on whether the in-laws communicated to indicate if wisterias were part of their respective gardening

projects. Lisa Pearson, Head of the Library and Archives of the Arnold Arboretum, reported that no wisterias were sent from the Arnold Arboretum collection to Cornell University between 1910 and 1970 (only *Viburnum* and *Acer* were distributed between the institutions at that time). Since the Farrand family moved out of the A.D. White House 1937, it is unlikely that Margaret Farrand was involved with the wisterias present at Daisy’s Garden today. Edward Cobb, a now-retired researcher of Plant Sciences at Cornell and a fabulous source of institutional knowledge regarding plants, mentioned that wisterias have grown on campus since the ’60s, and they were radically pruned in the ’80s during renovations. As for identification, Kim Klein, who has maintained the garden for several years now, said that some plants have white flowers and others have blue flowers. Still, this did not suffice to identify the wisterias, as there is a wide range of flower colors even within the same species. We also communicated with Nina Bassuk, emeritus professor and program leader of the Urban Horticulture Institute at Cornell, who said that some plants could be *Wisteria floribunda*. This hint was corroborated by observing a voucher herbarium specimen collected by former staff members of the L. H. Bailey Hortorium Herbarium at Cornell University



Voucher of *Wisteria floribunda* collected at Daisy's Garden by W.J. Dress in 1953.



Wisteria plants growing in Ithaca at A.D. White House, Cornell University

and by observing that some of these plants twined left to right (clockwise). Although this information was starting to point to one species (*Wisteria floribunda*), we were still not 100 percent certain. Besides, we still needed at least five more plants to complete our sampling.

The Revelation Through DNA Barcoding

To make sure we would have biological replicates from the same species, we decided to dive deeper into the biology of wisterias and explore potential genetic markers (a gene) that could accurately differentiate them. This method consists of using a short sequence of DNA from a specific gene to identify species, similar to ancestry DNA testing or scanning a barcode in a supermarket—hence the name “DNA barcoding.” In 2019, James A. Compton and collaborators generated an evolutionary (phylogenetic) tree for wisterias and closely related species. To build this tree, they used four different genes. We analyzed this data to decide which of those genes would be most informative to perform the DNA barcoding approach for wisteria. We selected the chloroplast intergenic spacer gene “*ndhJ-trnF*”. We used leaves to extract DNA from ten plants in Ithaca, including the one plant from the

Commons, six plants from A.D. White House and three plants from West Campus. After a couple of days in the lab, our DNA barcoding analysis revealed that the specimen from the Ithaca Commons belonged to *Wisteria sinensis* while the other two populations were *W. floribunda*. Because most of the populations belonged to *W. floribunda*, including large-stemmed specimens with successive cambia, this species was an excellent candidate to understand the odd vascular patterns in the stems of woody vines.

We are currently investigating the first transcriptomes of wisteria stems from different developmental stages, which were paired with transcriptomes of the same developmental stages in common bean, another climbing plant from the legume family (Fabaceae), which does not form successive cambia. By comparing the transcriptomes from different developmental stages of the stem in wisteria and bean, we will be able to make several comparisons within each species and among species, further improving our ability to identify which key genes are turned on and off during the formation of successive cambia. Our hypothesis is that the genes involved in the formation of vascular cambium and secondary growth in trees are also involved in the development of successive cambia, but with distinct patterns of

gene expression—that is, they might be turned on and off at different developmental stages, at different tissues and/or at distinct levels. Once we describe the gene expression similarities and differences between the stems of wisteria and bean, other pairs of plants will be included in our analysis to further reveal the genetic underpinnings of successive cambia across seed plants, a trait that has evolved more than a dozen times across seed plants.

From a research perspective, as we constantly visit these plants in the field, we also pay attention to other interesting aspects of climbing plants. For example, a conspicuous feature is the “searchers shoots”—young branches able to move and attach to the support—or the fact that successive cambia are prevailing in basal, contorted, or compressed stems. These apparently subtle characteristics may be clues to understanding how wisterias climb and grow thick and strong, reaching the top of trees, houses, and trellises. Undoubtedly, as we investigate the developmental mechanisms of cambium formation in wisteria, we cannot help but grow curious about how the stems of other woody vines are constructed. Do they have successive cambia too? Do they have similar gene expression patterns to produce secondary growth? Given that eastern North American-Asian distinct species receive high priority with respect to collection development in the Arnold Arboretum, wisteria also has the potential to stimulate the acquisition of new taxa (e.g., *Padbruggea*) to foster comparative studies of native plants in the US in the future. It seems that incorporating this temperate cousin of wisteria would not only expand the phylogenetic diversity within this clade, but would also bring horticultural benefits, since *Padbruggea* species are climbers with similarly beautiful flowers. In the end, we hope you continue to appreciate the beauty of wisterias as you wait for winter to pass to admire their blossoms, or you realize how they slowly strangle their support to climb to the top. Yet, if you find yourself wanting to discard a wisteria, we would be happy to help you by cutting some of the large stems to get more data, as we continue unraveling the mysteries of secondary growth in woody plants. 🌿

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Meeting the Neighbors

By Laura Thorne and Michael Marino

I started to draw local landmarks soon after I moved from the west coast of Canada to a close-knit, rapidly gentrifying Caribbean neighborhood bordering Brooklyn's Prospect Park. Wracked with useless newcomer's guilt and a terrible feeling of isolation, I put my pen to paper—as though the careful study and reproduction of the neighborhood could save it, or at least temper my influence on it. As though I could create a home through the sheer diligence of spending forty hours inking individual bricks.

About a year into the pandemic, as the sirens wailed through my devastated neighborhood, I moved to a small, lonely apartment right next to the park and became ill with a mysterious cluster of symptoms. Each day, I dragged myself outside to walk through the park, circling the same loop as my body spiraled into what would be diagnosed as permanent chronic illness. In this doubly strange context, both the world and me spinning into crisis, I turned my gaze to the trees.

I want to say that I was pulled to learn each species by name and to identify them by their leaves, buds, bark, and habits. I wasn't. The trees in the park were too strange, too seasonal, and too architected; nothing like the impossibly dense, unfathomably green forests of cedar and hemlock where I grew up, where every inch of space is claimed by a living thing. The trees of Prospect Park didn't create a home for me. I didn't even experience them as place. They were more like neighbors, with their own private stories, their own reasons for ending up in an unlikely locale, and their own strategies of perseverance.

What I connected with most was simply what I saw as I drew: glorious configurations of light and dark, cluster and line, each one similar but completely itself. I didn't need to know who they were to hear what I needed to hear from them—a simple invitation towards continuity. I'm grateful to the trees for that, and to arborist Michael Marino of the Prospect Park Alliance, whose contributions to this essay allowed me to finally meet my neighbors. —LT

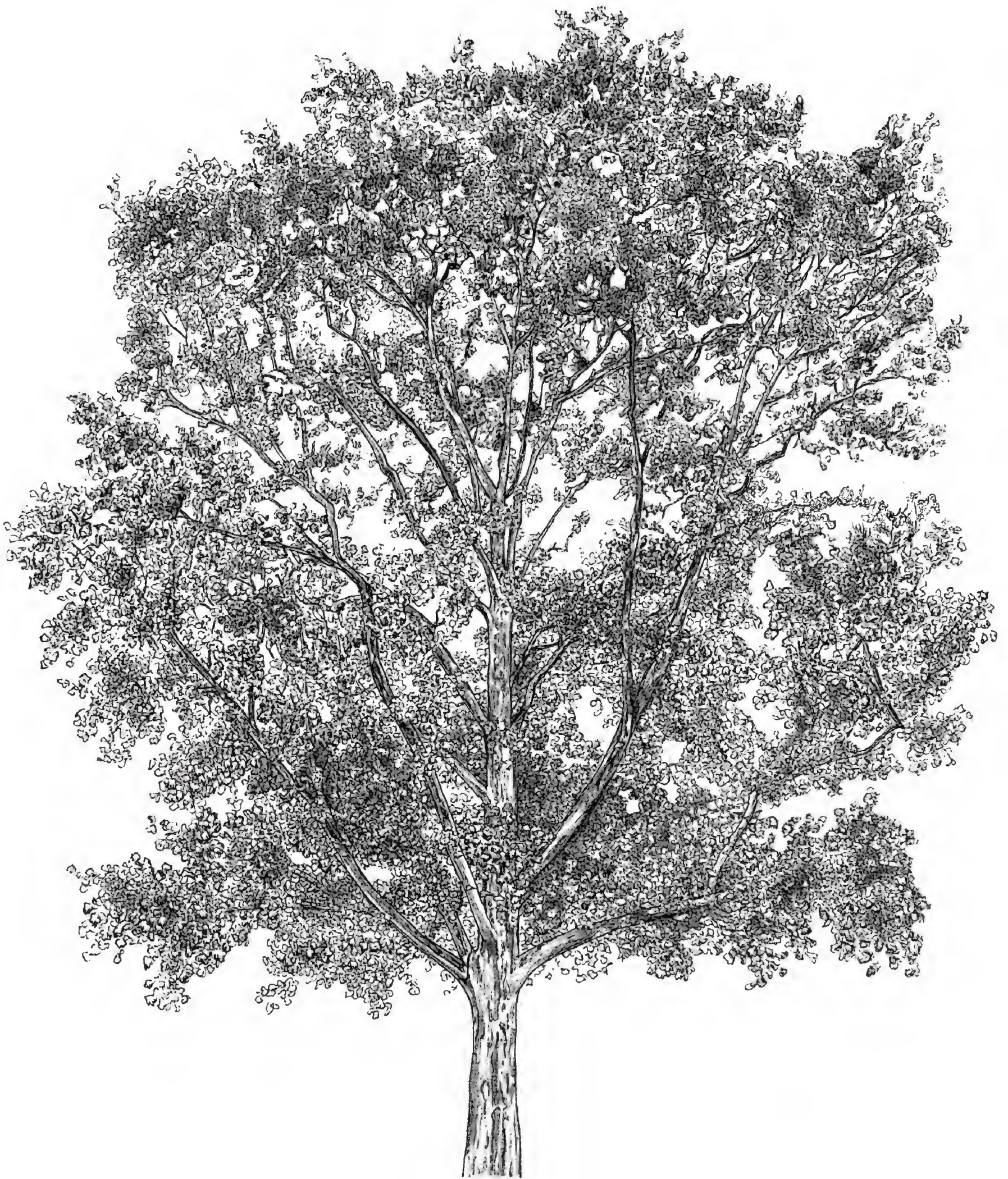
London Plane

(*Platanus × acerifolia*)

The hallmark of the New York City urban canopy, these trees are known for being resilient, drought tolerant, and dependable. Often overlooked, though, is the beauty of their camouflage-like exfoliating bark and impressive crown spreads. Today's park boasts many gorgeous specimens, but none compare to the original allées planted during the park's construction. —MM

LAURA THORNE is an artist and art director currently living in Catskill, New York.

MICHAEL MARINO is an ISA-certified Arborist and serves as the Forester of the Prospect Park Alliance.





Camperdown Elm (*Ulmus glabra* 'Camperdownii')

Certainly the most famous single tree in Prospect Park, the Camperdown elm was donated to the park in 1872. It's a true veteran: it endured half a century of neglect prior to the founding of the Prospect Park Alliance in 1987, after which it was put on life support in the form of cabling and bracing. Now it is circled by a cast-iron fence. Last year, it dropped a dead limb, which was mostly being held up for aesthetics. We decided to leave the dead branch in place on the ground, putting natural history on display as the limb decomposed and recycled its nutrients back into the tree. The loss of the branch was significant for park-goers, who have an abiding love for this tree. For me, the beauty of the Camperdown elm is the gnarled, naturalistic look it maintains despite being a grafted cultivar. Looking at it, one thinks there must be gnomes or fairies living in it. So far, all we can verify is that stray cats sometimes curl up in its hollows.



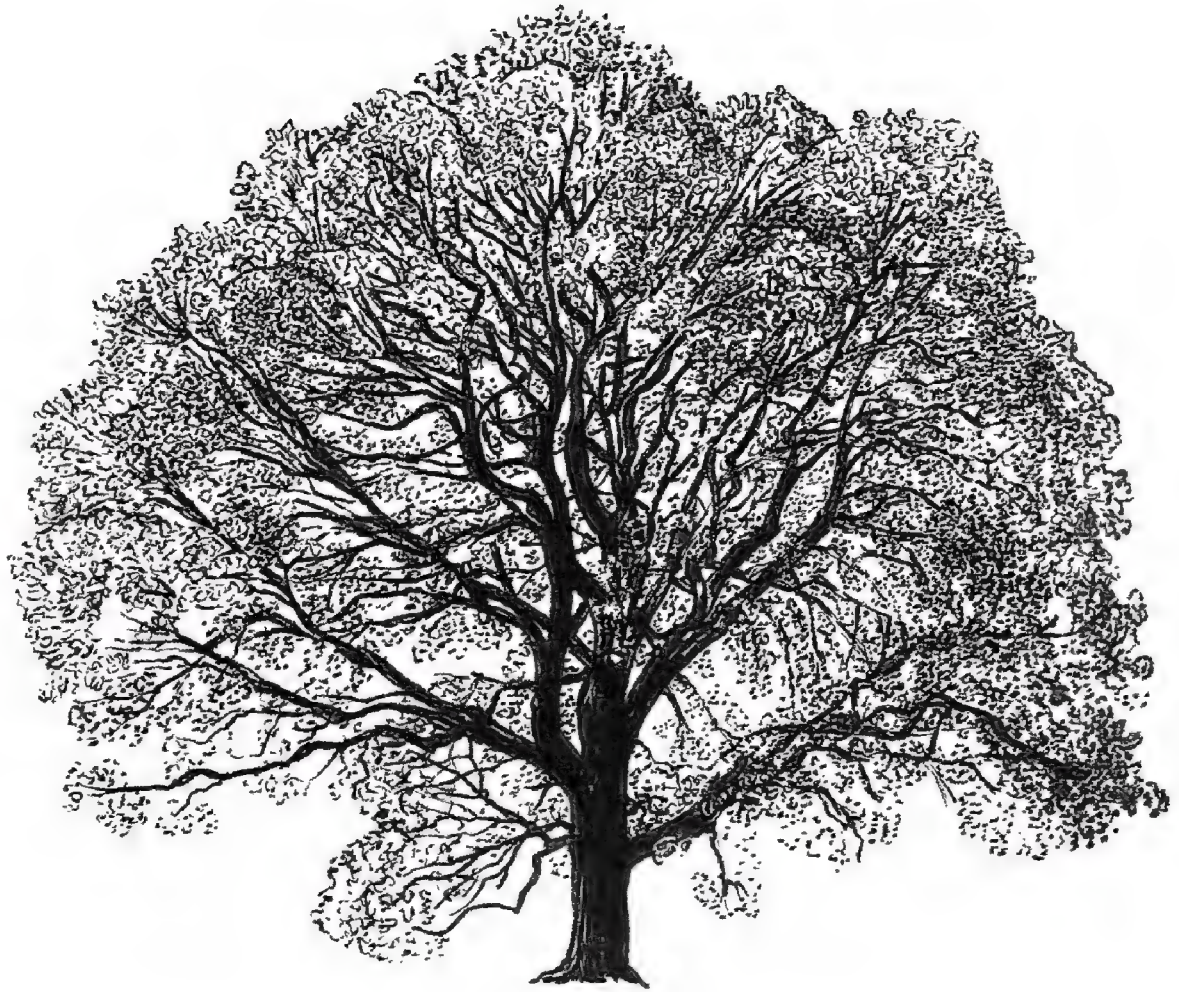
Japanese Pagoda (*Styphnolobium japonicum*)

The Japanese pagoda is an easy tree to love, with its handsome habit and creamy white mid-summer flowers. The Alliance isn't planting this species anymore, though, as our Landscape Management team is working very hard to promote our native ecosystems. While not officially invasive, the Japanese pagoda is a prolific seeder, and sprouts from this tree are noticed in our woodlands. Nevertheless, we do our best to preserve the existing specimens: after all, they are still gorgeous living things. The specific tree shown here is a good example of the conflicts we face with tree care in the park, both in terms of native/invasive dialogues, and in terms of public interaction with trees. The two sprawling branches on the bottom seem to beg people to climb on them, which is harmful for the tree. We have already lost one branch, and we will likely remove the other to support the tree's overall health.

American Elm

(*Ulmus americana*)

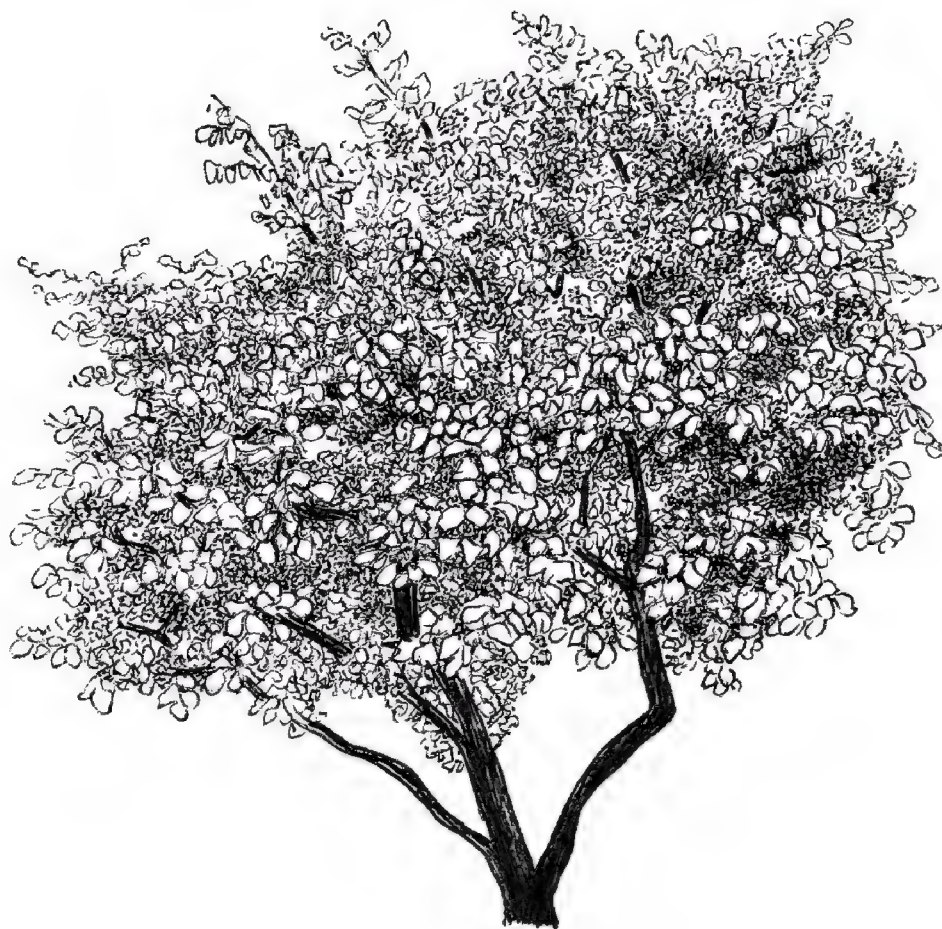
Prospect Park is lucky to have some behemoth specimens that have made it through the devastation of Dutch Elm Disease, including some mature elms measuring over 50" diameter at breast height. The Alliance is doing what it can to support these trees, including watering, mulching, protecting from soil compaction, and removing flagging branches. We are also working with the City of New York and the New York State Department of Environmental Conservation to treat for Dutch Elm Disease.

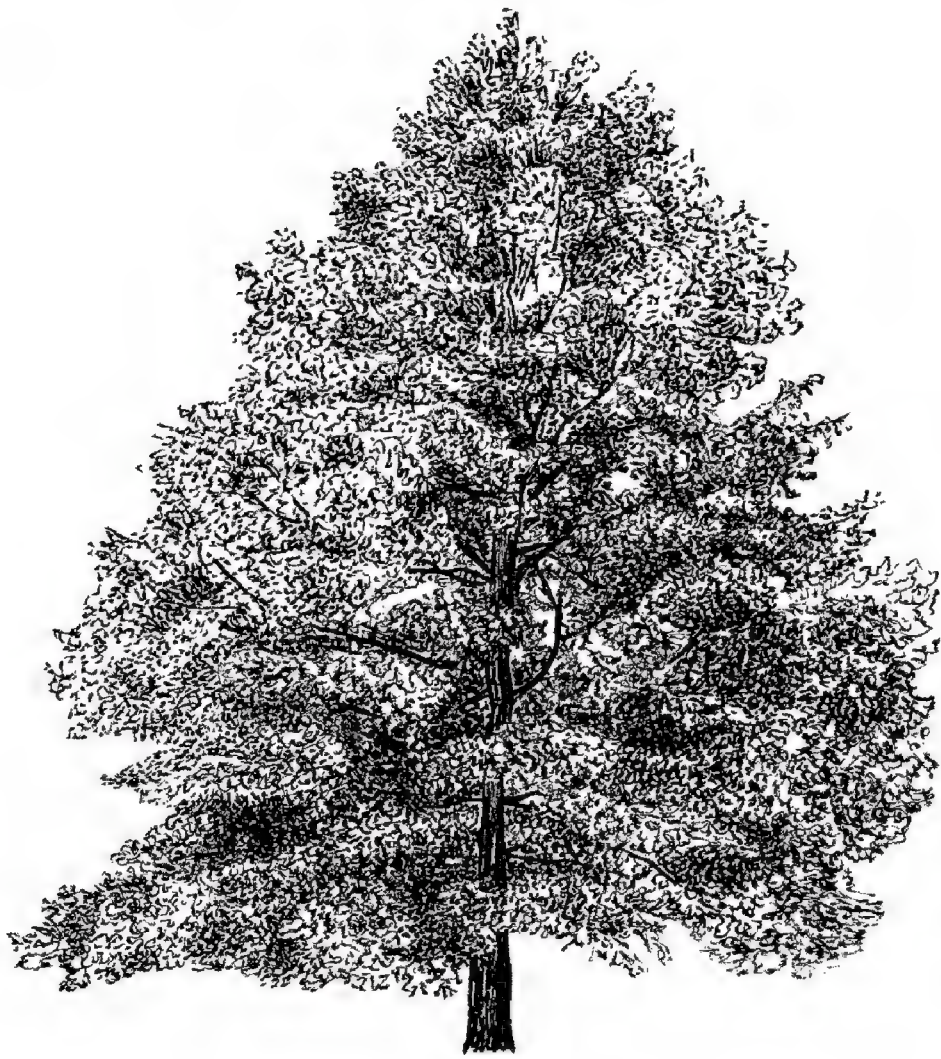


Eastern Redbud

(*Cercis canadensis*)

Those deeply purple flowers are a real highlight of early spring. Unfortunately, its multiple stems are irresistible to young climbers. The park gets ten million visits each year, and the tree can't sustain ten million climbs, particularly as *Cercis* don't live very long anyway: 50 to 70 years at best.





Willow Oak

(*Quercus phellos*)

My favorite tree in the park is the staggering willow oak at the edge of our woodlands on the peninsula. Three people holding hands could barely reach around its trunk. Aside from this old monster, I like the species for several reasons. They usually occur further south, so they may prove resilient to our changing climate. Willow oaks also seem less affected by bacterial leaf scorch, which has cost us a number of trees in the red oak group. I also enjoy the novelty of an oak with leaves that don't look like an oak—it's fun to throw at somebody who is just beginning to identify trees.



Hawthorn

(*Crataegus viridis*)

Along with dogwood and redbud, hawthorns round out a trifecta of native understory trees suitable as landscape specimens, with hard wood and lovely spring flowers. I also value them for their natural defense against human damage: their thorns, which are the reason I avoid planting them near playgrounds, or areas where day camps congregate.



Propagations

ART ENTANGLED

Magnitudes of Magenta

By Matthew Battles

I was freshly arrived as the editor of *Arnoldia* when Peter Del Tredici suggested I consider Amy Lowell's poem, "Magnolia Gardens" (page 25), for the magazine. Eager to bring contemporary verse to our pages, I filed the poem away. But the strange horror in Lowell's verse—her "curves and colors.... Reeking with sensuality"; the "fire of magenta" inspiring Lowell not to wonder, but "disappointment"—kept pulling me back to her lines. Philosophy famously begins in wonder, but Lowell's lyric begins in disappointment. With spring again swinging into view, I recall afresh that I go to the garden for surprise, delight, discovery—for wonder foremost. Why then for Lowell this disappointment? What's wrong with magenta?

Colors, like the passions, have excited the wonder of gardeners as much as philosophers. "We treat desire as a problem to be solved," writes the essayist Rebecca Solnit, noting "the distance between us and the object of desire that fills the space in between with the blue of longing." She encourages us to shift our perspective, to cherish the longing itself, "since it is as inherent to the human condition as blue is to distance." What then of magenta? This hue combining the blue of distance, of longing, with the red of blood and the body. Not as mixture or mingling, but as harmony or hybrid, a special kind of consonance. To Goethe, colors are "the deeds and sufferings of light." In "Magnolia Gardens," magenta's deeds are misdeeds, and suffering is everywhere.

In many plants, pigments called anthocyanins produce the hues described as magenta. These pigments absorb ultraviolet light, and thus are often present in young plant structures,

from the bud scales of shagbark hickory to the tepals of magnolia, where they protect thin, fragile, fast-growing tissues from the damaging bands of sunlight's spectrum. Depending on their chemistry, these pigments can be red, purple, blue, or even black. In their endless variety, intermixture, and modulation, they transmute light in shattering, scattering, braiding variations of wavelength—a quilted sea of sunlight flooding the garden, exploding, unquenchable, overflowing.

Magenta is what's called an "extra-spectral" color: a compound of red and blue wavelengths in combination—not a single note, but a chord. The light falling on these soft petals took some eight minutes to arrive from the sun. Born out of fusion reactions at the sun's core, these energies storm the solar midlayer, where innumerable collisions rob them of energy. Escaping at last through charged regions of plasma and the corona, they fly through space, scatter their blues through the atmosphere, and pass through a magnolia petal, where a smattering of woven, whirling wavelengths catch in folds of protein in one of your retinal cones, exciting a sense of magenta. Indeed, this soft storm of wildly-woven light fills up the garden with a menagerie of colors—"exploding amid light-colored peace," indeed!

Although the color it names has always been raveled from sunlight's skein, "magenta" is a modern coinage, named for an 1859 battle fought between French and Austrian forces at the town of Magenta in northern Italy. Among the French forces was a regiment of Zouaves, whose dashing uniforms of blue and red were inspired by the Berber fighters of French North Africa. Though the battle was small in scale, it

proved a turning point in the war, and news accounts forged a link between the exotic image of the Zouaves and the town of Magenta. That same year, a team of British chemists synthesized a new reddish-purple pigment from coal-tar derivatives, the product of a revolution in the manufacture of dyes from fossil fuels in the mid nineteenth century. They named “magenta” after the battle, perhaps simply to capitalize on the notoriety of a major news event. Or maybe it was the hue of the fezzes worn by the Zouaves in engravings of battle scenes that inspired them. As for the town itself, it took its name from Maxentius, the Roman emperor defeated by Constantine I in 312 CE. On the eve of the battle, Constantine experienced a vision promising him victory under the sign of the Christian cross. So the name “magenta” is blood-drenched, a sanguine vision, blued with the distance of time and the exotic.

None of these reasons explain Lowell’s disappointment, however, as magenta “explodes” and upsets the “light-colored peace” of the garden: the misty violet of *Wisteria*, the white of Cherokee rose, the exotic fragility of *Banksia*. Even amid the violent energies of magenta, Lowell finds solace and surrender in these whitened, softening hues. Rebecca Solnit tells of the vogue among renaissance painters for the blue of distance: “when you look at these paintings you can imagine a world where you could walk through an expanse of green grass ... and then at some point arrive in the blue country: grass, trees, houses become blue, and perhaps if you look down at yourself, you too would be blue.” Where then is Amy Lowell headed in the early twentieth century, exploding into this magenta of longing and the body? What *is* this magenta? We’re inclined to presume it’s the color of the magnolias featured in the poem’s title, though in fact Lowell never names the source. In its volatility and violence, it seems almost sourceless, though it takes vivid shape in the “curves and colors” of “Rubens women shaking the fatness of their bodies.” It’s “raw,” corporeal and corpulent, expressing an “opulent egotism”—who wouldn’t want

Lowell
conjures
magenta
in such
voluptuous
terms
that it’s
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disbelieve
her dislike.

some of that? An uncanny, synaesthetic color—it’s “reeking with sensuality”; it’s “bestial, obscene”—Lowell’s *e*’s bracketed with spittle-blowing sibilants and plosives. And if, as the closing line suggests, colorlessness is peace, it is a strange peace of nonlife, which the vitality of the magnolias’ magenta lovingly destroys. Lowell conjures magenta in such voluptuous terms that it’s tempting to disbelieve her dislike for the color.

Lowell’s “disappointment” is even more incredible when looking elsewhere in her work, which rarely is prudish when it comes to botany or the body. Indeed, she often is expressively erotic—as in “The Weather Cock Points South,” a poem from 1919:

I put your leaves aside.
One by one:
The still broad outer leaves;
The smaller ones,
Pleasant to touch, veined with purple;
The glazed inner leaves
One by one
...
White flower,
Flower of wax, of jade, of unstreaked
agate;
Flower with surfaces of ice,
With shadows faintly crimson.
Where in all the garden is there such
a flower?

These opalescent flowers prefigure the moon-shaped stars and constellating blooms of “Magnolia Gardens”—though here, the purple-veined and faintly crimson petals aren’t “bestial” or “obscene,” but pleasant and above all, rare. Why the horror in South Carolina?

Given her propensity elsewhere for erotic, body-botanical flourish, I wonder whether Lowell’s entire orientation in “Magnolia Gardens” is ironic—an irony that is born, moreover, of her own sense of vulnerability and precariousness: as a northerner in southern landscapes of violence and enslavement; as a woman contending with obesity; as a lesbian. For in her verse and beyond it, Lowell was a target of complaint, derision, and revulsion beyond the pages of *Poetry*. Fabulously wealthy and

unconventional, she also was obese at a time when the American body was being interpreted in new ways. Fellow poets derided her with nicknames I won't repeat here; according to literary scholar Melissa Bradshaw, contemporary criticism of Lowell went beyond bodily description. In body and person, critics deem her "voracious, engulfing, and out of control.... Everything she does, says, or touches becomes imbued with images of consumption, gluttony, and sloppiness as her bodily excess becomes a metaphor through which her entire person is interpreted."

Lowell's response was to embrace her notoriety, to feed off its energy. In an infamous performance in 1915, Lowell read an early poem in which her narrator describes taking a bath, luxuriant as the "sun-flawed beryl water" flows over her body. As the formidable Lowell declaimed, Bradshaw relates, a "suppressed snicker ... rose to a roomful of undisguised laughter" from an audience that "could not listen to a poem and forget that a fat woman was reading it."

Lowell's lyric on monstrous magnolias, too, touched off a nerve—readers from the South wrote into *Poetry* to complain about Lowell's identification of magenta in "Magnolia Gardens." One correspondent reports that he visited the garden in the same season as Lowell; and while he saw "many shades of pink and some reds," of magenta he found an "irreducible minimum, if any." Walker continues in a tone we recognize today as mansplaining: "They tell me it takes blue to make magenta. As Miss Lowell was being fêted in the choicest southern style, how can there have been blue in her outlook, to mix with the reds and produce magenta?" Walker concludes that Lowell's poem "misses the color of the scene and is therefore dubious art."

For all its beauty, the landscape Lowell visited along Charleston's Ashley River was touched by the legacy of slavery, the myth of the Lost Cause, and the evils of Jim Crow. "Magnolia Gardens" was the first in a series of three Lowell poems that appeared in the same issue of *Poetry*. The next poem in the series, "A South Carolina Forest," peers

through the gloom of southern woods to uncover the horror of lynching: "There are butchered victims behind those trees/And what you say is moss I know is the dead hair of hanged men." The third poem, "The Vow," risibly invokes the "lost cause" of the South, beseeching the dead "who die/Unconquered" to "deign some gesture of forgiveness/To those of our sundered race/Who come in all humility/Asking an alms of pardon." Lowell seems to envision reconciliation between the white north and white south, beseeching some "benefice of love poured down on us from these magnolia-trees./That, when we leave you, we shall know the bitter wound/Of our long mutual scourging healed at last and sound."

Together, the three poems take a strange trip through southern gothic gardens: from explosions of voluptuousness, past the ghoulish roadside remnants of racial oppression, toward city streets and squares ringing with conciliation. Why then was it her use of the color magenta that drew complaint? Perhaps it was a matter of displacement—a faltering in the face of the hard truths of the South's bloody past and Lowell's squirm-inducing splay of burgeoning bodies. "Magnolia Gardens" bathes the vivid intimate reds of sex and death with the blue of distance, sweet roses, and the distant grasses. Well, but what is the garden but a zone of harmony and contrast, a melting pot of cyans and yellow-reds and, yes, magentas, where the tangled pulses of different wavelengths converge, ripple, and interweave?

A dappled world, spilling over with colors of many colors. After chill days of bud break, the magnolias here in the arboretum bloomed into an April heat wave, and the fragrances of many cultivars, rose and citrus-soap and musky humors, mingle now in the sudden humidity. In the heat, the tepals emerged smudged and streaky-brown, and began dropping early. They still are falling as I write, a thickening litter of floral shards in white and pale and, yes, the flare of raw magenta. Still lively, the color bathes us in a relishing of wave and resonance. And I am not disappointed. 🌿

Matthew Battles
is the editor of
Arnoldia.



SMALL WORLD

How to Reach the Future (A Tale of Four Seeds)

By Bonnie Costello

The meadow was in its late season dying. What had been purple and gold just a month ago was all browns, grays, and blacks. The old stalks were rattling on about the future. Would there be a future? It didn't look promising. Even if there were, how to get there when you can't travel. The mower would be here any day, so the question was urgent.

The wind died down and there was a long silence.

The jewelweed spoke first and was surprisingly pithy. Having lost its bloom, it was all wound up inside, and oh so touchy. "Ballistics!" it burst out. "Ping!" The spiderweb trembled; the beetle paused in its tracks. The projectile had little impact. The meadow was used to these explosions. Some seeds were catapulted several inches off and landed in the dry loam. The stream bank was more promising, but already crowded, so the future would look much like the past.

The burdock was biding its time. What it had to say needed to stick. "Why all that energy turned inward just to advance a few inches? I'll get my hooks into a hide or a fleece, a sleeve or cuff, and hitch a ride! Wherever it's going, it will get you out of this meadow." Nobody said it but a look around the meadow made it clear. The grazers and amblers had been bypassing the burdock, clingy and irritating free loader.

The thistle now made a surprising point. Only a week ago it resembled a bottle brush, but it was going soft in the head.

"I can be sharp against encroachers. But to reach the future one must dream!" This seemed a vague directive until a gust of wind came up and pulled out a handful of fluff. A lot of it drifted into the pond or collected in the road. But some floated farther off, who knows where.

The coneflower offered nothing during this debate. A highlight of the meadow in summer, now its withered petals were sorry to behold. The plant stood tall but inert on its stalk. It seemed to have no plan. It wouldn't go far, was the silent consensus.

Just then a surfing goldfinch looking for rest and food on its journey south paused on the grim pedestal and pecked. "How can it let itself be devoured like that?" the other stalks whispered. The wind gathered up the goldfinch, leaving an even more pitiful stalk, and a cone head emptied of seed.

An hour later, on a pit stop in Connecticut, the goldfinch dropped some of the seed from its gut. The litter was swaddled in a bit of nourishing bird dirt and nestled in garden loam, where it soon froze. The next spring, up it came, into its new surroundings.

The gardener was a careful steward, but not rigid about her design. She knew the world was changing. She liked surprises and would not call them weeds. So she let the coneflower flourish, at least for that season.

And why not? Hadn't her own children—she could see them still, eyes wide, noses dusted with pollen—gone off and rooted themselves among strangers? What, after all, *is* the future? Not a place you could point to. A link with the present, not a repetition. Even the seasons were shifting. High winds were toppling her favorite trees. She was worried and took measures. But gardeners are optimists by disposition if realists in practice. She didn't like the current talk of doom. Let the wind blow, the seeds disperse. Let the whole yard become a meadow once she moved on.

And what of the meadow where our tale began? Now there is a forest or a parking lot. But here's a purple thistle out of the broken sidewalk, some jewelweeds strung along the ditch. And here's a passing stranger who remembers what a meadow is. 🌿

Bonnie Costello, a professor emerita in English at Boston University, has published many books and articles on modern poetry, and literary essays on art, travel, and landscape.

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Planting History

By Adrienne Ross Scanlan



A tree has a trunk, a plant has leaves, and for decades, I left it at that until I decided to plant trees. I had the usual reasons: fear from seeing forests in flames and streams in drought from climate change, fear of losing the world's beauty, which I myopically defined as birds, fish, wildlife. But not flora. Not trees. Having now planted hundreds of trees and other flora, I can say that planting trees was easy. Seeing trees was hard. Even harder was seeing that trees are a small part of what I'm planting in the place I call home.

Walking in my backyard garden amid laurels and magnolia, which even I knew were out of place for western Washington, I understood a tree was a plant with woody tissue. A tree can be deciduous, which means it loses its leaves at the end of the growing season (typically fall in the temperate world but during the dry season in the tropics, which I learn from later reading). Or it can be a conifer, which means it has seed cones, and often, but not always, is evergreen. (More reading.) Trees have only one trunk, as opposed to multi-stemmed bushes. This book-based knowledge, gathered by strangers over the centuries, was of little help with my in-the-forest floral short-sightedness.

Because to me, a yellow cedar looks like a western red cedar, and because a western red cedar is not so easily distinguished from an incense cedar by examining the seed cones, and because salmonberry doesn't look all that different from

black raspberry, nor sticky currant from red flowering currant, and because I can always identify a Douglas fir (if I find the seed cones), and because reading floral keys is only slightly less confusing than deciphering Egyptian hieroglyphics in the days before the Rosetta Stone, usually I looked for birds and left Pojar and Mackinnon's *Plants of the Pacific Northwest* gathering dust atop my bookshelf.

When planting at a city forest, suburban park, or other restoration site, I'd encounter forest stewards or volunteers with more botanical knowledge than I have. (It wasn't hard to find these people.) My question was simple: "What is this?" Their replies were cryptic: "Look at the buds." (Alternate or not, whatever that meant.) Or "Is the bark smooth?" (Is any bark smooth?) I scribbled notes hoping to create a personal library of plant lore. Once home, I'd puzzle over abbreviated words on muddy pages, hoping to recall enough to shape a story to be read another day. To be fair, deciduous trees in winter are hard to identify, but a

winter planting meant the trees went in the ground when flora was dormant and the rains (hopefully) abundant. But dormancy also meant twigs and limbs were in wait, leaves hadn't emerged, flowers were a hope for next spring, and where others could see cascara from twinberry, all I saw was a stem in black dirt in a black bucket that looked like any other stem in black dirt in a black bucket.

But my difficulties weren't simply seasonal or experiential. James Wandersee and Elisabeth Schussler's classic definition of plant blindness describes me all too well, namely as having "the inability to see or notice plants in one's own environment," which in turn creates "an inability" to understand how important plants are to life on earth, and therefore to humans, not to mention general oversight of the "aesthetic and unique biological features" of flora, and "the misguided, anthropocentric ranking of plants as inferior to animals, leading to the erroneous conclusion that they are unworthy of human consideration."

Blindness implies a physical inability to see. But is the issue a physiological difference or a psychological indifference? Studies have shown (that deadly phrase) that when people view images of flora and fauna in rapid sequence, we pay attention to and remember animals far more than plants. (There's the question as to whether we don't see plants, or we see animals more.) Humans see what matters to them. Plants often don't. While girls tend to be more interested in plants than boys, most youth (and presumably the adults they become) are more interested in animals because animals are more like us: they move, eat, often have human-like eyes, faces or appendages, give birth, raise young, and sometimes play with us. There are other reasons, too, more related to plant nature than human nature.

Plants hide in plain sight. Being immobile, plants need to attract bees and other pollinators to reproduce, but they also need to be inconspicuous to herbivores. Seasonal flowering, with its bursts of smells and colors, attracts pollinators, while seasonal

Rooted as
they are in
the past,
trees turn
toward the
community
they have
now, and
the world
to come.

dormancy lets individual plants blend in with the plants around them, creating a floral herd that reduces the chances of predation on any one plant.

I see this survival strategy as a green blur on the landscape, whether as small as my suburban garden or as vast as a mountainside, a static image that requires interest and effort to identify sword fern from maidenhair fern from lady fern. Why bother? Some plants sting, some cause rashes, some are poisonous, but none are going to hunt me down for dinner. While flora may be a staple of horror (think *Day of the Triffids*), a predatory kwanza cherry tree doesn't lurk in my garden.

But there's another reason for plant indifference, at least where trees are concerned. A tree isn't in a forest; a forest is in a tree. I see a tree trunk easily enough. Massive, rooted, comforting in what persists across seasons, years, decades, centuries, and deeper into history. To walk amid what might be western hemlock in my backyard is, I've read, to walk atop an underground network of roots laced with mycorrhizal fungi, a symbiotic relationship where trees provide carbohydrates and fungi provide water and soil nutrients. Through that network trees share carbon and other resources, and seedlings are nourished. Rooted as they are in the past, trees turn toward the community they have now, and the world to come.

In *The Nation of Plants*, botanist Stefano Mancuso writes "Plants are what make Earth the planet we know. Without them, our planet would very much resemble the images we have of Mars or Venus: a sterile ball of rock." Plants, or more specifically the chloroplasts in their leaf cells, are the bridge between our world and our sun. Chloroplasts make it possible for plants to absorb solar energy—sunlight—and convert it to chemical energy—sugar—with oxygen as the resulting waste product. Oxygen for breathing, corn and barley and much more for eating, wood for paper and books, and boards for building, and an endless list of gifts, from fabrics to dyes, to be grateful for, and all thanks to the plants.

We know this. And yet, we (or I) ignore it. I'm slowly opening my eyes to see that to be plant indifferent is to ignore a daily miracle of life, one seen by the strangers who lived here before me, and the strangers who will live here after me.

There's a straight line of sun-starved western red cedar along my garden's south border. What dispute with a neighbor was too large for the trees to restrain, necessitating a fence of rain-rotted wood and cat tunnels? Even in my small backyard, stories are written in Oregon grape and English ivy as one era took root alongside another. But perhaps every garden is its own library, stands of knowledge for those who open seed cone, turn over leaf, and read the history blooming here, if one notices.

My garden was once a plant nursery. When the business failed in the 1970s, the owners sold to a condo developer with the stipulation that the family house and its immediate landscape remain intact. The widow lived here for years and bequeathed the house to a wayward son, as if the family home was a diary to be read for remembering better days. The son, so the story goes, re-mortgaged the house, ignored taxes, initiated lawsuits, fled to the Southwest, and died.

We've found remnants of a beloved place. In the southwest corner, laurels tower over a woodshed shattered to dust, rusty nails, spider webs. We cleared a path through fallen branches and sawed off low-hanging boughs. From the gloom emerged alders laced with woodpecker holes. We hauled single-shot booze bottles, belt buckles, shoes, and broken pottery out of English ivy to uncover a stone-walled pond filled with dirt and laurel shoots, and a broken bench beside a rain-rotted bird feeder atop a tilting metal pole that had been hidden beneath Himalayan blackberry that we cut and tore and piled on the walkway alongside the English ivy. But once, this was a family's place of rest and wonder. And before that?

If I leave my garden and walk east along a four-lane arterial past an elementary

This neighborhood of single-family homes with Free Little Libraries was once a rainfall-nourished bog, most likely written into the landscape by the retreat of glacial ice.

school, past a bus kiosk memorializing the life and murder of Edwin Pratt, a local civil rights leader, and past statues of prancing ponies, then just before the Interstate 5 entrance ramp, I would come to Ronald Bog Park, once a wetland mined for peat in the 1930s. Mining ended some thirty years later. What was left of the wetlands were to be filled and made into suburban homes. In the early 1970s, local women, dismissively called the "kitchen table activists," advocated for preservation before the County Council, building on support from the local Audubon Society, educators, school children, and others. Ronald Bog Park, named after a local judge for reasons clear to no one, is now an arboretum of firs and cedar, sequoia and spruce, with grass, goose shit, fluffy-feathered goslings, and gravel trails, a refuge for coyotes and encampments for the homeless.

Landscapes change, and species with them, and the people living there. Sometimes, something remains. Here in my

backyard, scattered sets of salal struggle against grass, and amid Spanish bluebell and daffodils, I find what I think is trailing blackberry, a native plant. My backyard, and this neighborhood of single-family homes with Free Little Libraries by drive-ways, was once a rainfall-nourished bog, most likely written into the landscape by the retreat of glacial ice some 10,000 to 12,000 years ago to later become a crossing ground rich in flora gathered by local Coast Salish indigenous communities migrating to and from what's now called Puget Sound to Lake Washington. Prior to European contact, and still today, Puget Sound is home to Duwamish, Suquamish, Puyallup, Muckleshoot, and many other tribes (listed by their contemporary names) who spoke variants of Lushootseed. Years and centuries and lives ago, an indigenous woman would have carried her child through a fen that's now my lawn. She would have gathered trailing blackberry, bog cranberry, salmonberry. She would have burned shrubs or other undergrowth to foster flora desired for food and medicine, or small game to hunt. She would have known gratitude for life in such a beautiful place. At least, I hope she did. She would have had her own worries for the future. (Who doesn't?) Was she alive when the first white settlers reached Puget Sound? She's of the past, but like the plants, her descendants live here still despite broken (or non-existent) treaties, introduced diseases, and forced displacement; they defend their rights and help shape the future of this beloved place. But could she have imagined a future so different from the abundant world she knew?

In the slight page of my garden's history book, I write a brief note with every Shukshan strawberry planted for summer salads, every rosemary and lavender planted for pollinators, every primrose and Persian violet planted for joy. I plant salal under the cedars and Oregon grape near yet another plant I (still) don't know. It's low to the ground, with twists and whorls of bright green, pointy leaves. With upwards of 300,000 flowering plants in the world, I'll never know them all. I can't

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honestly say I'll ever come to see even a reasonable number of them, either, amid the false-forget-me-nots I've learned to notice. But what's a future without some unexpected glimpse of beauty and the joy it brings? What's a future, anyway, if not a realm of possibilities, a few certainties, a place worthy of hope? And the Pacific crabapple and vine maples, the cascara and grand firs, even the flora I don't (yet) have names for that I'm planting in parks and along trails? Those are letters written to someone else's future, which is a history I won't live to see.

One day, someone will sit on a bench under a Japanese maple and never know I planted it with the ashes of a son who was wanted but died in utero. Just as I will never know what beloved creature's ashes were wrapped in a plastic bag and buried in a box only to be accidentally dug up when I planted the maple. I reburied the crematory amid innumerable weeds I can't name, Himalayan blackberry, and Garry oak.

Reaching out to rest my hand on that oak, I remember stories of a forest planted thousands of miles away. I've never found a citation, but the story rings true. Centuries ago, an English university built a library, with trees felled to give weathered refuge to books written and ones yet to be imagined. Those long-dead librarians must have trusted there would be a future where curiosity would blossom, and beams would rot. And so, a forest was planted so that there would be trees to build a new library.

One day, someone else will walk my garden of madrone and magnolia, cedar and cypress. Will that distant stranger almost walk past, but stop, place hand against bark, watch sunlight shift in leaves, wonder why this tree grew in this place? What matters, the names or the noticing? Perhaps even asking is another sign of my plant indifference. At the risk of being horribly anthropocentric (or only human), I trust that stranger will let curiosity root, will learn about the people who cared for this beloved place through the centuries of a tree's life, and one day, will plant a new tree for someone else's future. 🌿



Watering New Plants

By Rachel Brinkman, Manager of Horticulture

300
Gallons in the largest towed hand-watering supply

5
Gallons applied weekly to plants in their first season

For their first three years, newly planted trees and shrubs get extra care and attention out in the landscape. They are closely watched, kept mulched, weeded, and most importantly, receive extra water. Water stress is the leading cause of death for a newly planted plant. For their first growing season in the landscape, we aim to provide them with about five gallons of water every week. This is equivalent to an inch of rain fall per week until the plant’s root system gets established.

The Arnold Arboretum will plant roughly three to five hundred new trees, shrubs, and vines every year. This can turn into a lot of watering—especially in years of drought—and these young plants are all watered by hand from tow-behind water tanks. We have 300, 200, 100, and 50 gallon water tanks, which may all be in use during hot dry periods in the summer. In addition to watering, the plants are monitored for pests, diseases, damages, dieback, and weed control. We take our young plant care very seriously here! 🌿

Photograph by Rachel Brinkman



"Today I have grown
taller from walking
with trees." — p.19

